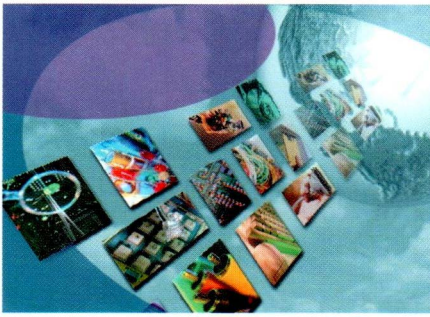
NORTEL NETWORKS™

Meridian 1

Remote Services Products Guide

Meridian 1

Remote Services Products Guides



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Remote Peripheral Equipment

553-2601-200

Fiber Remote IPE

553-3001-020

Carrier Remote IPE

553-3001-021

Fiber Remote Multi-IPE Interface

553-3001-022

Meridian 1

Remote Peripheral Equipment

Description, installation, and testing

Document Number: 553-2601-200
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Description

Remote peripheral equipment (RPE) increases the 15 m (50 ft.) range of the loop between the common equipment (CE) and peripheral equipment (PE) shelves in an SL-1 system.

The increased range enables the PE to be placed closer to the stations it serves, which in turn increases the serving range of the SL-1 system.

RPE uses a carrier link between the local and remote ends. The carrier link may consist of one of the following:

— a wire pair with no repeaters or other interfaces (in-house IRPE)

— a digital carrier link meeting T1 interfacing specifications (such as Nortel Networks LD 1)

— a microwave radio link (which meets T1 interfacing specifications)

— a fiber-optic link (which meets T1 interfacing specifications)

Equipment configuration

Reference list

The following are the references in this section:

- *Circuit card installation and testing (553-3001-211)*

Carrier system

A block diagram of the basic RPE system is shown in Figure 1. A 1.544 Mbps multiplexed digital carrier system (such as LD-1), or a microwave radio link, is required for each RPE system. A maximum of two network loops may be connected through two RPE carrier shelves (one shelf at the local equipment location, and one at the remote location). A complete RPE shelf (two network loops) requires four digital carrier lines.

Carrier shelf

The same type of carrier shelf for the RPE is used at the local and remote locations. The QSD6 (left-hand mounted) and QSD11 (right-hand mounted) shelves may be mounted in any SL-1 peripheral equipment (PE) cabinet. The power supply connector is a two-pin type. Each shelf has a power converter card to derive its required voltages from a -48 V supply provided by a QBL14 Power Distribution Box. All cables from the carrier shelves are connectorized.

Each loop services a maximum of four PE shelves. RPE network loops are fully assigned to RPE use, and no other PE shelves can be served by these loops.

Each loop requires four cable pairs (two carrier lines) between the carrier shelf and the carrier system for transmission and signaling. A maximum of two cable pairs is required for maintenance purposes. These are the order-wire (OW) and fault-locating (FL) pairs, and are optional depending on the distance between the carrier shelves and on the location of the office repeater bay (ORB) in the system.

Each RPE system requires at least one ORB (see Figure 2) and line repeaters, unless the remote equipment is within about 762 m (2500 ft) of the SL-1 equipment. Locating the ORB at both local and remote ends of the carrier line is strongly recommended. This effectively allows the isolation of the carrier span from the SL-1.

An ORB provides the following:

— span line powering

— error monitoring

— fault-locating (FL) system access

— order-wire (OW) termination with digital distance dialing (DDD) access

— line looping

A typical RPE configuration is shown in Figure 3. Each RPE system requires a carrier shelf at the local and remote locations. These are cabled to the SL-1 cross connect terminal through two NE-A25B cables.

Carrier shelves at the local equipment location and at the remote location are connected to QPC50 network cards and peripheral equipment shelves, respectively, through NE-A18QA connector cables.

Peripheral equipment shelves at the remote location are connected to the cross connect terminal through four NE-A25B connector cables in the same manner as are regular SL-1 PE shelves. For cabling and termination instructions, see the installation procedures for the system.

Two network loops connect to the carrier shelf. Each can serve a maximum of four PE shelves. Circuit card positions 1 through 4 and 5 through 8 serve network loops X and Y, respectively.

Circuit cards

The same circuit cards are used in the local and remote carrier shelves (see Figure 3), except for the QPC63 (local) and the QPC65 (remote) cards. All circuit cards have designated slot positions on the carrier shelves, and they must be kept in these positions to function properly. The QPC62 and QPC99 cards have option switches on their circuit boards. Circuit card handling procedures and option switch settings are given in *Circuit card installation and testing (553-3001-211).*

Emergency transfer

Designated 500-type telephones can be cross connected through emergency transfer units to outgoing trunks at the remote location. The telephones are connected to these trunks when the normally operated relays of the emergency transfer units release as a result of any of the following:

— loss of –48 V carrier shelf power

— loss of –48 V or ±10 V (under control of the QPC84 Power Monitor circuit card)

— carrier failure

Note: Network loops are controlled independently.

— manual operation of emergency transfer switch on consoles

Note: This will not affect a remote location.

— manual operation of emergency transfer switch on the QPC84 circuit card

Figure 1
RPE block diagram

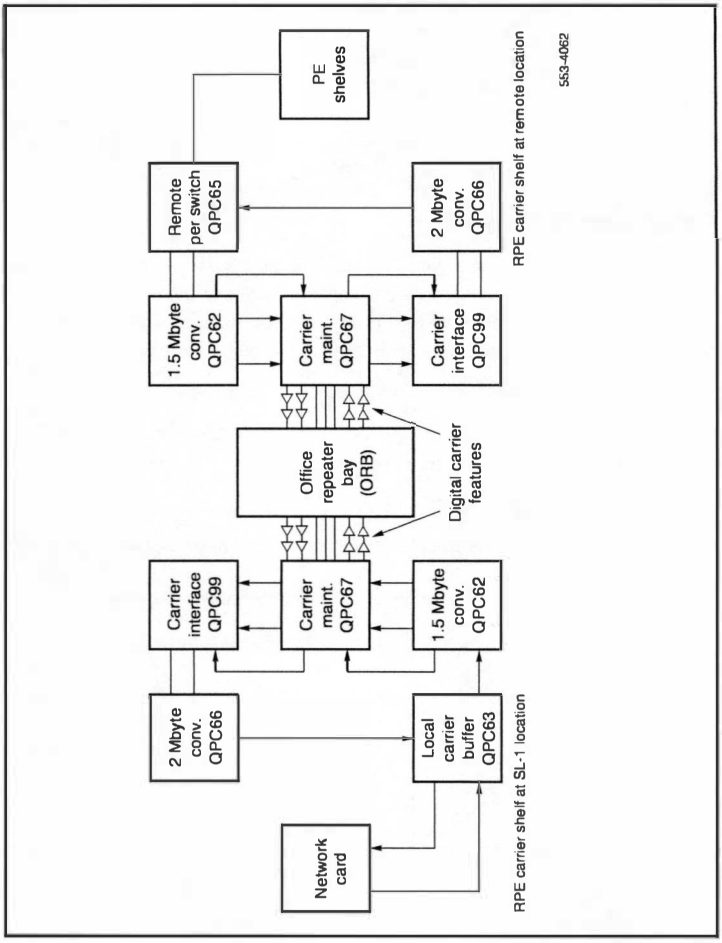


Figure 2
Possible ORB locations in the RPE system

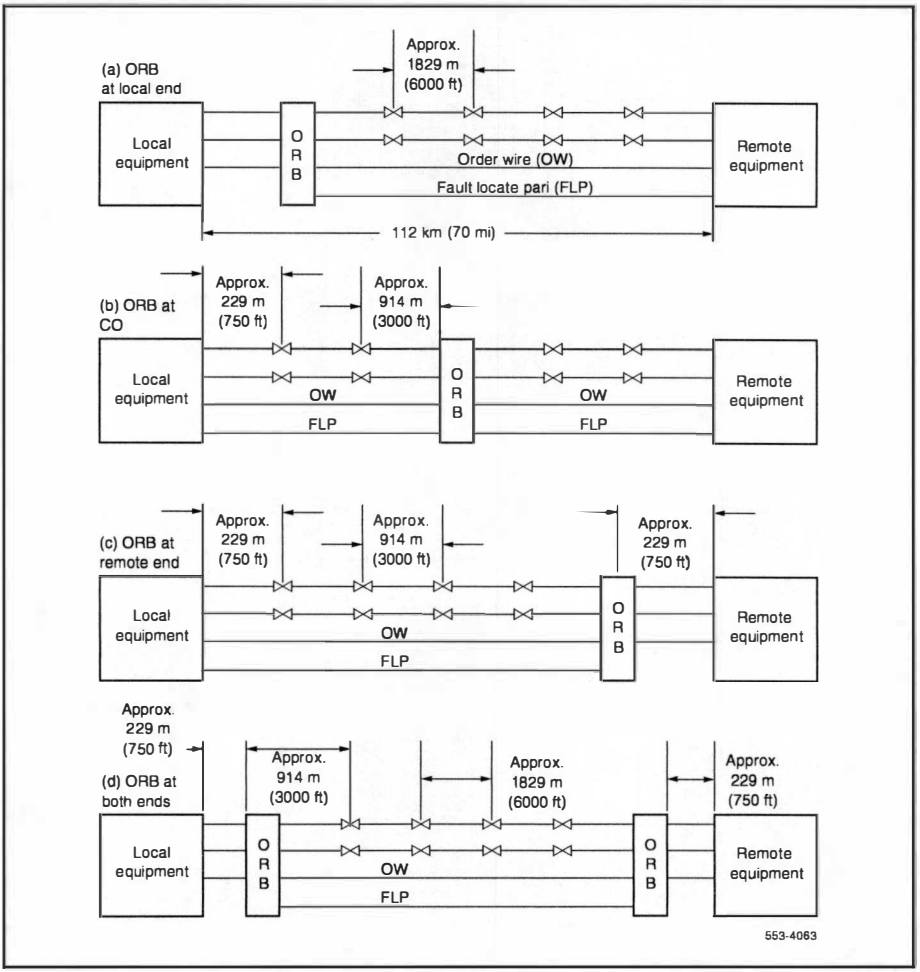
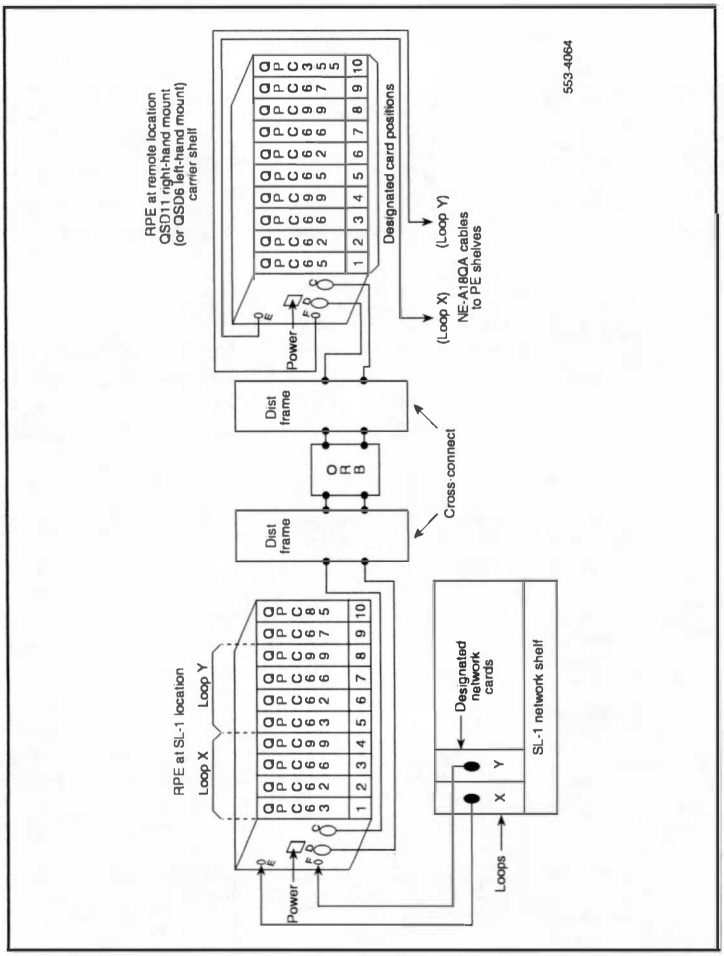


Figure 3
Typical RPE equipment configuration



Equipment description

Reference list

The following are the references in this section:

- *Meridian 1 equipment identification (553-3001-154)*

Cabinets

RPE equipment is housed in standard SL-1 cabinets. A QCA8, QCA37, or QCA74 cabinet is required at the remote location to provide power for the QBL14 Power Distribution Box that powers the carrier shelves. A QCA6, QCA8, QCA23, QCA37, or QCA74 cabinet may be used at the local location to house the QBL14 Power Distribution Box.

The RPE carrier shelves may be installed in any SL-1 cabinet (except QCA60). They must be within 3.8 m (12.5 ft) of the QBL14 Power Distribution Box.

Carrier shelves

The following carrier shelves are available:

— QSD6 left-hand mount shelf

— QSD11 right-hand mount shelf

Function

The carrier shelves accommodate the circuit cards listed in Table 1. These cards can function only in the designated card positions shown in Figure 3.

Table 1
Carrier shelf circuit cards

Location	Product code	Description	Quantity
Local and remote	QPC62 QPC66 QPC67 QPC85, QPC190, QPC355 QPC99	1.5 Mbaud converter 2.0 Mbaud converter Carrier maintenance 5/12-V converter Carrier interface	2 per network loop 2 per network loop 1 per shelf 1 per shelf (Note) 2 per network loop
Local only	QPC63	Local carrier buffer	1 per network loop
Remote only	QPC65	Remote peripheral switch	1 per network loop

Note: QPC190 and QPC355 circuit cards can be used only in QSD11B series B and QSD6B series B shelves or QSD11C and QSD6C shelves. QSD11B series A and QSD6B series A shelves only work with a QPC85 circuit card. Using the QPC190 in the earlier vintage shelves will damage both the QPC190 itself and the QPC99 carrier interface.

Quantity

One shelf is required at the local and remote locations for each two network loops.

Location

Any PE shelf position in a cabinet must be within 3.8 m (12.5 ft) of the QBL14 Power Distribution Box that powers the shelf.

Features

The carrier shelf features are as follows:

— steel and aluminum construction

— printed circuit backplane

— fully connectorized power and signaling connections

— international rack mounting standards (48.3 cm [19 in.])

— approximate weight of 15.9 kg (35 lbs) when fully equipped

PE shelves

Left- or right-hand mount shelves are used. See *Meridian 1 equipment identification (553-3001-154)* for a description of these.

QPC62 1.5 Mbaud Converter Card

Function

The QPC62 converts an SL-1 loop into two carrier loops. It contains switch-selectable line equalizers.

> ***Note:*** QPC62C converters, and converters of later vintage, must be used when the 12 V option setting is required.

Quantity

Two are required for each network loop: one in the local carrier shelf, and one in the remote carrier shelf.

Location

Place the QPC62 in the following positions:

— slot 2 for the first network loop in each carrier shelf

— slot 6 for the second network loop in each carrier shelf

QPC63 Local Carrier Buffer Card

Function

The QPC63 performs the following functions:

— generates a 1.544-MHz clock from the 2.048-MHz clock

— provides enables and decodes outgoing and incoming data

— delays incoming data from the carrier so that its frame, relative to the outgoing data frame, is equivalent to that returning from a peripheral buffer

— relays line status information to the processor

— decodes line control information from the processor

Quantity

One is required for each network loop connected to the carrier shelf at the local equipment location.

Location

Place the QPC63 in the following positions:

— slot 1 for the first network loop in the local carrier shelf

— slot 5 for the second network loop in the local carrier shelf

QPC65 Remote Peripheral Switch Card

Function

Each SL-1 loop at a remote site has a remote peripheral switch (RPS) card associated with it. The card provides:

— shelf, card, and line enables, along with the bypass bit to the shelves it serves at the remote site

— cyclic scanning of the terminals it serves for incoming signaling messages

— monitoring of timeslot 0 for outcoming messages from the peripheral signaling (PS) card to the RPS or terminal

— assembling of incoming messages (RPS to PS)

Quantity

One is required for each network loop.

Location

Place the QPC65 in the following positions:

— slot 1 for the first network loop in the remote carrier shelf

— slot 5 for the second network loop in the remote carrier shelf

QPC66 2 Mbaud Converter Card

Function

The QPC66 converts two carrier loops into a single SL-1 loop.

Quantity

Two are required for each network loop: one in the local carrier shelf, and one in the remote carrier shelf.

Location

Place the QPC66 in the following positions:

— slot 3 for the first network loop in each carrier shelf

— slot 7 for the second network loop in each carrier shelf

QPC67 Carrier Maintenance Card

Function

The QPC67 performs the following functions:

— conducts fault-locate testing, using an M-type (3017 Hz) fault-locate filter

— detects DC for the fault-locate pair by means of DC-detection circuitry

— facilitates software maintenance testing, using loopback relays

— terminates and gives access to the order-wire pair through a jack and binding posts on the faceplate

Quantity

One is required in each carrier shelf.

Location

Place the QPC67 in slot 9 in each carrier shelf.

QPC85, QPC190, and QPC355 5/12 V Converter Cards

Function

The QPC85, QPC190, and QPC355 cards convert –48 V dc to +5 V dc and +12 V dc for the carrier shelves.

CAUTION

To avoid damage to the equipment, do not install QPC190 or QPC355 cards in QSD11B series A and QSD6B series A shelves; these shelves only work with a QPC85 card. Use QPC190 or QPC355 cards only in QSD11B series B and QSD6B series B shelves, or in QSD11C and QSD6C shelves.

Quantity

One is required for each carrier shelf.

Location

Place the QPC85, QPC190 or QPC355 in slot 10 in each carrier shelf.

QPC99 Carrier Interface Card

Function

The QPC99 performs the following functions:

— With two carrier line receivers and built-in 7.5 dB pads, it converts the bipolar line signals into TTL level signals. It also provides facilities for LD-1 carrier looping, monitors the system, and invokes emergency transfer if the carrier fails.

— By means of option switches on its circuit board, the card can be configured for a variety of locations and loopback conditions. In cards of vintages F and later, the –7.5 dB pads are also switch selectable. The settings on switches 1 through 4, and 7 through 12, determine the location of the card. Switches 5 and 6 determine loopback conditions. With switch 5 closed, the loop carrier is looped for an additional 8 seconds. With switch 6 closed, loopback occurs when DC is on the FL (fault-locating) pair and bipolar violations occur on the carrier. With switch 6 open, loopback occurs when

- DC is on the fault-locate pair and TRIOS is present
- DC is on the fault-locate pair and excessive bipolar violations (BPV) occur
- TRIOS is present

— The later vintages also have a ROUT jack for each channel to allow a test signal to input into the system. A manual loopback (MLB) switch is also added to allow looping of the system for fault clearing. All other features of the earlier vintages are retained.

Quantity

Two are required for each network loop: one in the local carrier shelf, and one in the remote carrier shelf.

Location

Place the QPC99 in the following positions:

— slot 4 for the first network loop in each carrier shelf

— slot 8 for the second network loop in each carrier shelf

Cables

The following cables are used in RPE installations:

— NE-A18Q to connect the local carrier shelf to a network card and to connect the PE shelves to each other and to the remote carrier shelf.

— NE-A25B cables are used to connect jacks C and D of the local and remote carrier shelves to the cross connect terminal, and to connect jacks A, B, C, and D of each PE shelf to the cross connect terminal.

QBL14 Power Distribution Box

Function

Distributes -48 V to a maximum of four carrier shelves. Equipped with circuits to provide a low voltage (-42 V) disconnect.

Quantity

One is required for every four carrier shelves.

Location

The QBL14 is placed above the QUX3 Power Distribution Unit, or above the QBL5 Power Distribution Box in a QCA8 cabinet. It may also be installed in a QCA6 cabinet above the QUX1 or QBL3 unit. In QCA28 and QCA37 cabinets, the unit can be mounted in any unequipped shelf location.

Assembly and installation

Reference list

The following are the references in this section:

- *Circuit card installation and testing (553-3001-211)*
- *Telephone and attendant console installation (553-3001-215)*

RPE equipment may be shipped fully assembled in PE cabinets or shelves, or the circuit cards may be shipped individually packaged for installation in existing PE cabinets.

When new cabinets are to be installed, refer to the appropriate system installation instructions for grounding and power requirements, wiring diagrams, and cabinet installation and inspection procedures.

Procedures 1 and 2 give the installation and cabling procedures for RPE shelves at the local and remote equipment locations, respectively. Procedure 3 describes the remote alarm installation. Figures 4 and 5 illustrate RPE shelf cabling.

Telephones, consoles, and add-on-modules are installed and connected as described in *Telephone and attendant console installation (553-3001-215)* and system installation procedures.

Procedure 1
Local RPE installation

Step	Procedure
1	Install the QSD6 or QSD11 (left-hand or right-hand mounted) carrier shelf with no circuit cards inserted.
2	Install an NE-A18Q cable from carrier shelf connector jacks E and F to each network card (see Figure 5).
3	Install two NE-A25B cables from shelf connector jacks C and D to the cross connect terminal (see Figure 4).
4	Insert a QPC85, QPC190, or QPC355 5/12-V Converter Card (depending on the shelf vintage) in slot 10. The QPC190 and QPC99 (Carrier Interface) will be damaged if the wrong card is used with the wrong shelf: see page 20 for instructions and cautions.
5	Follow cabinet inspection procedures if a new cabinet is installed.
6	If there is no existing RPE equipment, install a QBL14 Power Distribution Box (see Figure 6). See Note for trip circuitry information.
7	Install the power cable (supplied with the carrier shelf), connecting it from the QBL14 unit to the carrier shelf power jack (see Figure 6).
8	Terminate the cables.
9	Connect power to the RPE carrier shelf.
10	Check the option switch settings and header pin strapping on the QPC62, QPC66, and QPC99 cards (see Figures 7, 8, and 9). For more information, see *Circuit card installation and testing (553-3001-211)*.
11	Insert all other circuit cards in their designated positions (refer to Figure 3).

Note: The QBL14 Power Distribution Box located in the RPE contains undervoltage detection circuitry that trips the input circuit breaker when the DC input voltage drops below –42 V. This circuit prevents the RPE from dropping the battery voltage below –42 V, which would cause permanent battery damage.

Where battery backup is not provided, a short interruption of the main AC input power will cause the input breaker to trip. This interruption keeps the power to the RPE off when the AC power source is restored.

In this situation (no battery backup), you can disable the trip circuitry by removing the single wire from the D terminal on the input breaker of the QBL14 (see Figure 10). Wrap the disconnected end with insulating tape and dress the wire back.

Procedure 2
Remote RPE installation

Step	Procedure
1	Install the QSD6 or QSD11 (left-hand or right-hand mounted) carrier shelf.
2	Install the PE shelves (left-hand or right-hand mounted).
3	Install two NE-A25B cables from carrier shelf connector jacks C and D to the cross connect terminal (see Figure 4). Terminate the cables.
4	Install NE-A18QA cables from carrier shelf jacks E and F to the PE shelves for network loops X and Y (see Figure 4).
5	Install NE-A18QA cables between the PE shelves (see Figure 4).
6	Install four NE-A25B type cables from jacks A, B, C, and D of each PE shelf to the cross connect terminal. See *Telephone and attendant console installation (553-3001-215)* for designations and terminating procedures.
7	Follow cabinet inspection procedures if a new cabinet is installed.
8	If there is no existing RPE equipment, install a QBL14 Power Distribution Box (see Figure 6).
9	Install the power cable (supplied with the carrier shelf), connecting it from the QBL14 unit to the carrier shelf power jack (see Figure 6). See Note for trip circuitry information.
10	Insert a QPC85, QPC190, or QPC355 card (depending on the shelf vintage) in slot 10. Equipment will be damaged if the wrong card is used with the wrong shelf; see page 20 for instructions and cautions.
11	Connect power to the RPE carrier shelf.
12	Check the option switch settings and header pin strapping on the QPC62, QPC66, and QPC99 cards (see Figures 7, 8, and 9). For more information, see *Circuit card installation and testing (553-3001-211).*
13	Insert all other circuit cards in their designated positions (refer to Figure 3).

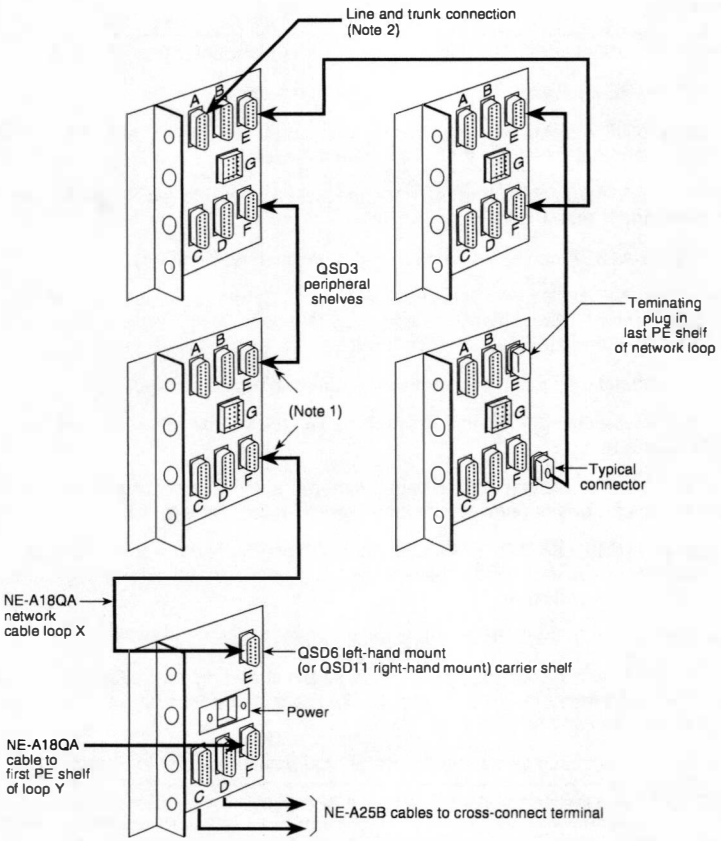
Note: The QBL14 Power Distribution Box located in the RPE contains undervoltage detection circuitry that trips the input circuit breaker when the DC input voltage drops below –42 V. This circuit prevents the RPE from dropping the battery voltage below –42 V, which would cause permanent battery damage.

Where battery backup is not provided, a short interruption of the main AC input power will cause the input breaker to trip. This interruption keeps the power to the RPE off when the AC power source is restored.

In this situation (no battery backup), you can disable the trip circuitry by removing the single wire from the D terminal on the input breaker of the QBL14 (see Figure 10). Wrap the disconnected end with insulating tape and dress the wire back.

The foregoing also applies to the QBL14 used with the local carrier shelves if reserve battery is not installed at the main location.

Figure 4
Remote end PE shelf and carrier shelf cabling



Note 1: NE-A18QA cables are available in the following lengths:
0.3, 0.6, 1.2, 3.0, 4.6, 6.0, 7.6, 9.1, 10.9, 12.1, 13.7 m
(1, 2, 4, 10, 15, 20, 25, 30, 35, 40, 45 ft)
Total length of cable from PE shelf to RPE carrier shelf must not exceed 13.7 m (45 ft).

Note 2: One of four connectors (A, B, C, D) cabled to cross-connect terminal via NE-A25B cables.

Note 3: Connector designations are similar on other PE shelf types.

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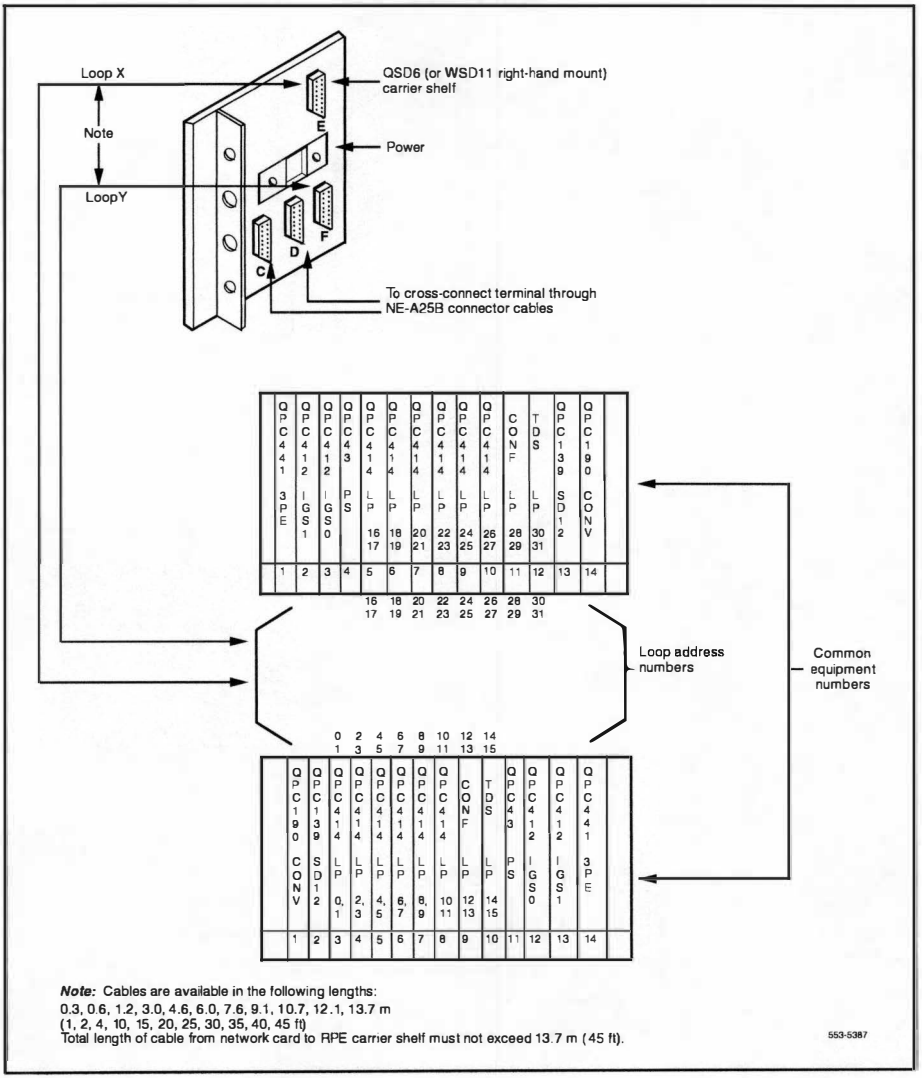
Figure 5
Local end network loop and carrier shelf cabling



Note: Cables are available in the following lengths:
0.3, 0.6, 1.2, 3.0, 4.6, 6.0, 7.6, 9.1, 10.7, 12.1, 13.7 m
(1, 2, 4, 10, 15, 20, 25, 30, 35, 40, 45 ft)
Total length of cable from network card to RPE carrier shelf must not exceed 13.7 m (45 ft).

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Figure 6
QBL 14 Power Distribution Box wiring and connections

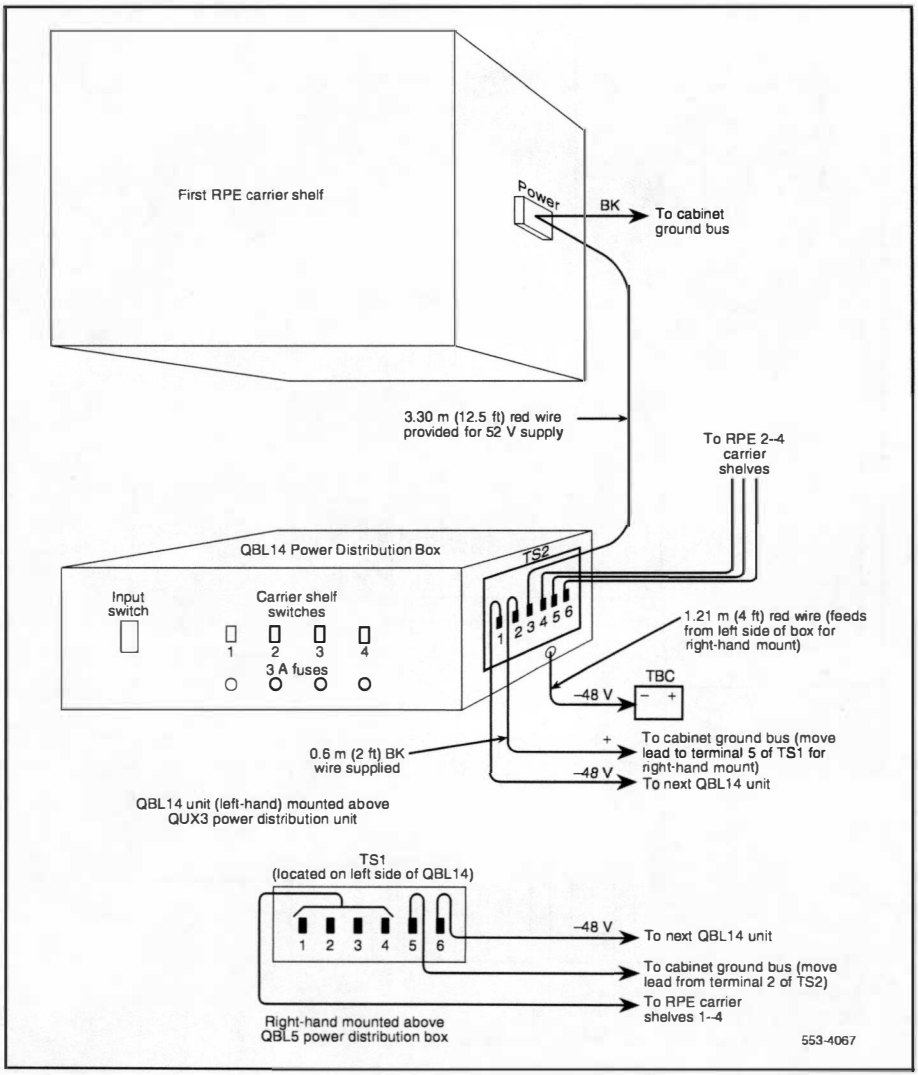
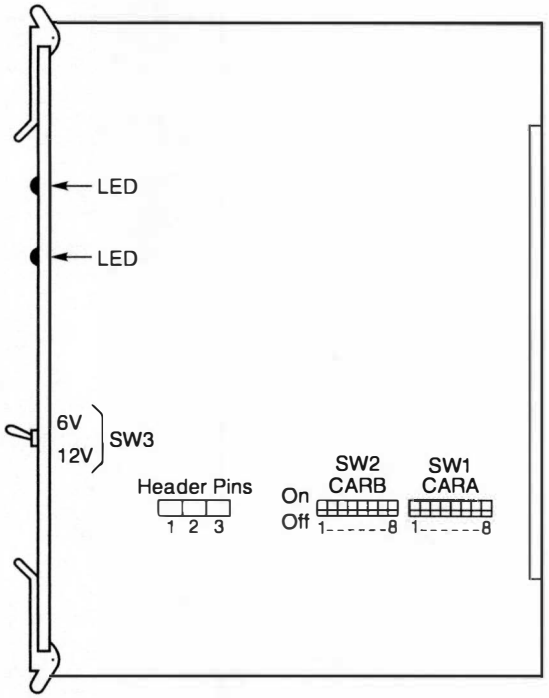


Figure 7
QPC62 1.5 Mbaud Converter Card option switches and header pins



Note 1: If cards are QPC62E or later vintage, insert the plug-in jumper (U-link) between header pins 1 and 2.

Note 2: If cards are QPC62D or earlier vintage, insert the U-link between header pins 2 and 3.

Note 3: QPC62E or later vintage cards must be provided for M, MS, N, N (QCA96), XN, XN (QAC97), and S systems.

Note 4: If QPC50K or later vintage is inserted in any system for RPE loop, QCD62E, or later vintage, must be used.

Note 5: Refer to *Circuit card installation and testing* (553-3001-211) for switch options.

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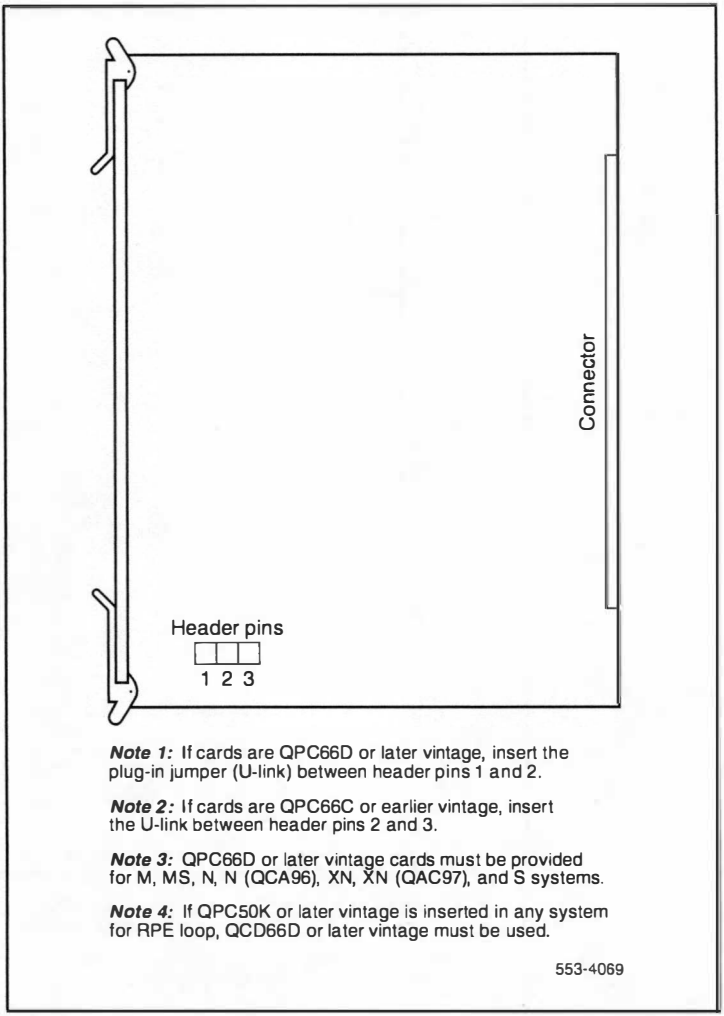
Figure 8
QPC66 2 Mbaud Converter Card header pins



Note 1: If cards are QPC66D or later vintage, insert the plug-in jumper (U-link) between header pins 1 and 2.

Note 2: If cards are QPC66C or earlier vintage, insert the U-link between header pins 2 and 3.

Note 3: QPC66D or later vintage cards must be provided for M, MS, N, N (QCA96), XN, XN (QAC97), and S systems.

Note 4: If QPC50K or later vintage is inserted in any system for RPE loop, QCD66D or later vintage must be used.

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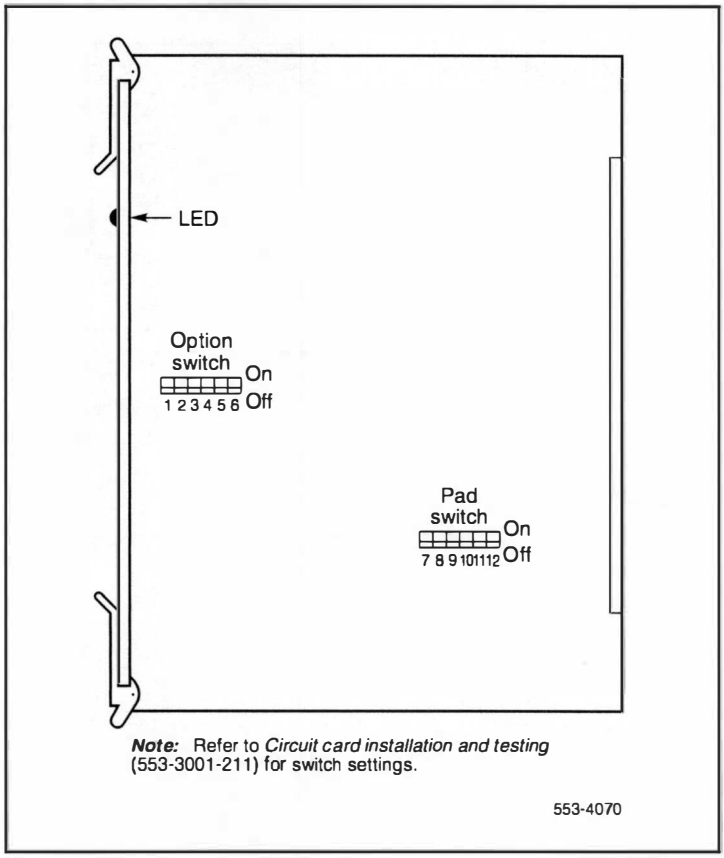
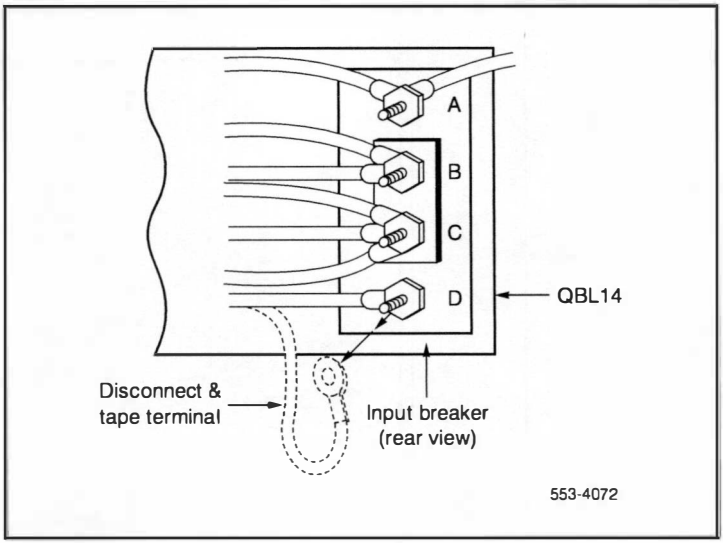
Figure 9
QPC99 Carrier Interface Card option switches



Note: Refer to *Circuit card installation and testing* (553-3001-211) for switch settings.

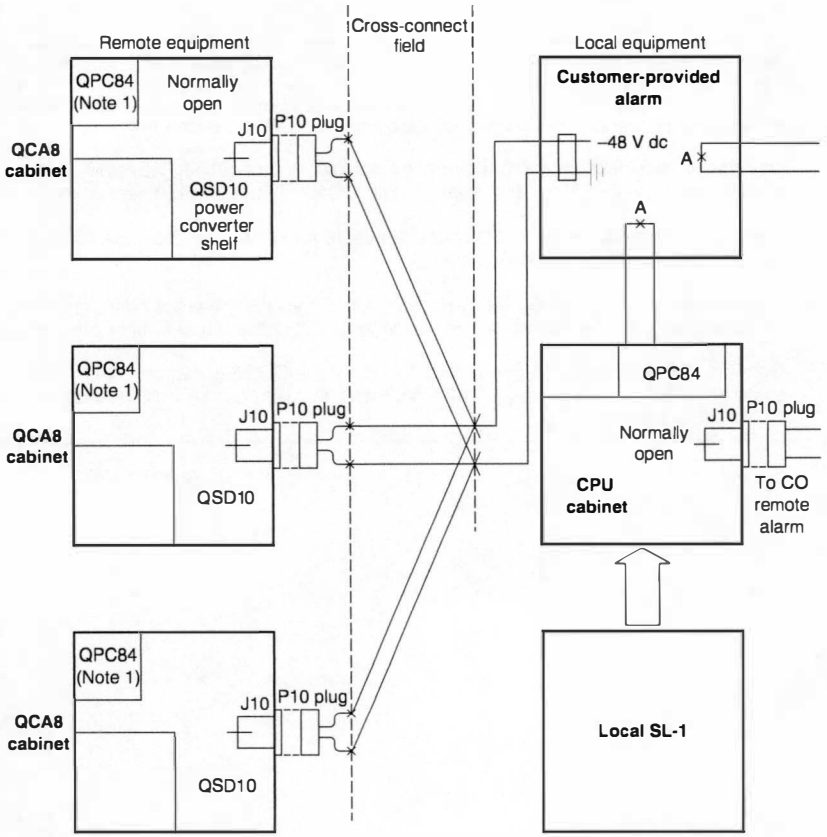
Figure 10
QBL14 Power Distribution Box input breaker



Procedure 3
Remote alarm installation

Step	Procedure
	Note: In an RPE installation, a power failure at the remote end cannot be detected at the local end. To overcome this, a wire pair can be connected from the remote QPC84 Power Monitor to the alarm input of the local QPC84 (see Figure 11). This can be used to generate a system terminal message, or a visual alarm, or both to indicate a power failure at the remote end.
1	Use the system installation procedures to install connector cables (NEA25B or equivalent) from the P10 plug of each remote QCA8 to the cross connect field.
2	Install and designate an NEA25B connector cable (or equivalent) from the cross connect terminal to the main location.
3	At the main location, connect the two alarm leads (through the cross connect terminal) to a customer provided alarm with provision for audio indication of remote power failure.
4	Connect two leads from the main alarm to TS3 of the QCA6 (L system), QCA10 (VL system), QCA23 (LE system), QCA24 (VLE and XL systems), QCA28 (A system), or QCA37 (SL-1M system).

Figure 11
Remote alarm connection



Note 1: The QPC84 card, in the power converter shelf, provides LED indication of out-of-tolerance voltages, and controls the system alarm indication.

Note 2: The rectifier is present in L, LE, M, and A systems only. When the QSD4 is not present, TS3 is located on OUT type power units (for fans).

Note 3: Refer to *System installation procedures* (553-3001-210) and *Telephone and attendant console installation* (553--3001–215).

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Carrier interface

Land-based carrier

The SL-1 RPE hardware interfaces with LD-1 carrier apparatus, which conforms to the T1 industry standard. Therefore, any carrier system conforming to T1 signaling standards should be able to interface with SL-1 RPE. Minor differences in carrier maintenance can generally be accommodated by option switches in the carrier interface card.

General engineering considerations

In addition to the T1 carrier rules, the following standards apply:

— The distance from local to remote equipment cannot exceed 112.7 km (70 mi).

— Line repeaters are powered from the office repeater bay (ORB), since no power is available from the SL-1 interface.

— The SL-1 interface with the LD-1 carrier line contains an M-type fault-location filter (3017 Hz) without level-of-polarity options. The FL filter is powered by the SL-1 RPE equipment. No other M-type filters can be used in the same span.

If an ORB is being used, the cable between the ORB and the cross connect (MDF) should have the following characteristics:

— The impedance presented to the SL-1 equipment should be 100 ohm at 722 kHz.

— The total distance between the SL-1 and the ORB or first line repeater should not exceed 228.6 m (750 ft).

— Cable should be designed for pulse code modulation (PCM) or digital signals, and should consist of individually shielded twisted pairs. Cable types NE-750A through NE-759A all meet these criteria.

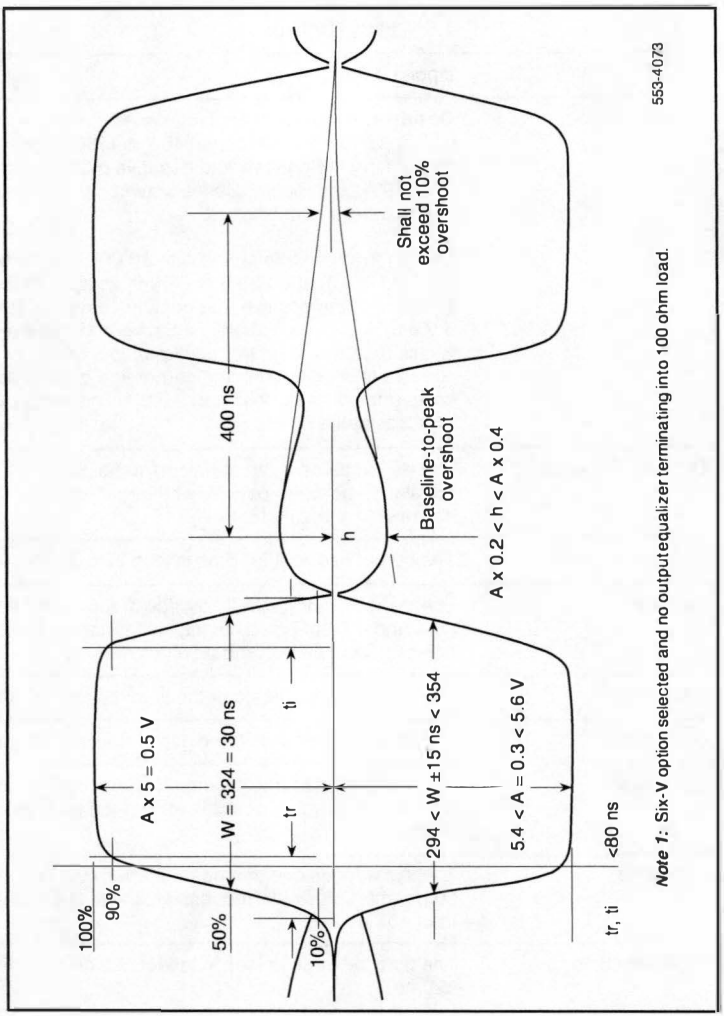
Carrier specifications

The SL-1 RPE is compatible with carrier facilities having the characteristics shown in Table 2 and Figure 12.

Table 2
Carrier characteristics

Line rate	1.544 Mb/s (±200 b/s)
Signal	bipolar, 50% duty cycle
Output level	**Option 1:** If the equipment interfaces directly with the carrier line, or with an ORB that is less than 45.7 m (150 ft) away from the common equipment, the positive and negative output pulse heights are 3 V ±10%, and the imbalance between the positive and negative pulses is less than 5%. **Option 2:** When interfacing with an ORB that is between 45.7 m (150 ft) and 228.6 m (750 ft) away from the common equipment, the positive and negative output pulse heights are 6 V ±10%, and the imbalance between positive and negative pulses is less than 5%. With this configuration, one of two possible equalizers is inserted in the carrier line in order to make the total cable and equalizer loss about 6 dB. This will provide the required 3 V pulses at the ORB.
Output pulse width	The output pulse width at half pulse height is 324 ± 30 ns. Imbalance between positive and negative pulse width at half pulse height is less than ±15 ns.
Output rise-and-fall time	The output rise-and-fall time is less than 90 ns.
Overshoot	The overshoot at the trailing edge of the output pulse is between 20% and 40% of pulse height, with decay to 10% or less of baseline-to-peak overshoot (within 400 ns).
Impedance	The nominal impedance at the line interface is 100 ¾.
Output jitter	The maximum jitter on the digital output signal can be 30 ns rms.
Input level	The positive and negative input pulse height will be in the range of 0.07 V to 3 V, with a possible imbalance between positive pulses of 5%.
Input jitter	The system can accommodate a low frequency input jitter of up to 20 ns rms. Jitter with frequencies above 2 kHz should not be more than ±50 ns peak.
Interpulse time	The time between pulses in adjacent time slots will be 648 ns ±20 ns.

Figure 12
Output pulse characteristics



In-house RPE

Since there is a carrier repeater located in the QPC99, it is not necessary to use ORBs and extra repeaters between the local and remote ends of the RPE if the distance between them is typically less than 762 m (2500 ft). In this case, the standard T1 procedures for cable installation should be followed. Other considerations are as follows:

— The impedance presented to the SL-1 system should be 100 ohm at 772 kHz.

— Unless the cable effectively separates transmit and receive pairs, separate cables for transmit and receive should be used to avoid crosstalk.

— Bridges, taps and loading coils, and building-out capacitors are to be avoided.

— Cable environment can affect transmission line capacitance and resistance, causing impedance mismatches and signal reflections. Cable should therefore be clean and dry.

Permissible in-house RPE operating distances depend on total losses and noise between the local and remote locations.

— If separate cables are used for transmit and receive directions, and if no noise or crosstalk from other pairs or external sources reaches the signal pairs, the maximum allowable loss at 772 kHz is 26 dB. In this case, the following approximate values apply:

Wire gauge (AWG)	Maximum cable length in meters (feet)
26	975 (3200)
24	1158 (3800)
22	1554 (5100)

— The following operating limits apply when several carrier systems are used without any additional equipment in the same group:

Wire gauge (AWG)	Maximum cable length in meters (feet)		
	4 RPE systems per group	8 RPE systems per group	12 RPE systems per group
26	762 (2500)	640 (2100)	579 (1900)
24	853 (2800)	732 (2400)	671 (2200)
22	1097 (3600)	914 (3000)	823 (2700)

— If only one twin carrier system and SL-1 equipment (such as SL-1 or 500-type telephones) are used in the same binder group, the following cable length limits apply:

Wire gauge (AWG)	Maximum cable length in meters (feet)
26	762 (2500)
24	853 (2800)
22	1079 (3600)

— If other high transient switching pairs are used in the same binder group, the maximum cable length is limited by LD-1 engineering rules for high noise environments and the following worst-case limits apply:

Wire gauge (AWG)	Maximum cable length in meters (feet)
26	579 (1900)
24	640 (2100)
22	732 (2400)

Microwave radio

Cabling between the SL-1 and the carrier facility should meet the criteria outlined for land-line carrier systems. In addition, the complete microwave system must also meet the overall limits for land-based carrier systems, and should conform to T1 interfacing specifications.

As in land-line carrier systems, the distance at which the SL-1 can operate is governed by a 1.5-ms timeout in the peripheral signaling card when interrogating the peripheral equipment. This 1.5-ms value is the maximum total round-trip time allowable, including propagation time and any delay introduced by signal processing at microwave stations. The maximum allowable distance (in miles) is given by:

$M \times V - D$

where
M = maximum allowable delay (ms)
V = propagation velocity (mi/ms)
D = any other processing delays (ms)

Example

In the case of a land-line system, assume that the maximum allowable delay (M) is 1.25 ms to give a safety margin of 0.25 ms. The propagation velocity (V) of signals through wire is 115 mi/ms. Assume that there are no delays (D) in the system. Thus the maximum allowable distance is 143.75 mi, as follows:

(1.25 ms x 115 mi/ms) – 0 ms = 143.75 mi

Connections

Reference list

The following are the references in this section:

- *Telephone and attendant console installation (553-3001-215)*

All cables, except cables to connectors C and D of carrier shelves, are terminated and designated as described in *Telephone and attendant console installation (553-3001-215)*. Connector C and D cables are terminated as shown in Tables 3 and 4.

Wiring to a QUA1 emergency transfer unit is cross-connected as shown in Figure 13 and Table 4.

Sets and consoles are cross-connected to PE shelves as described in *Telephone and attendant console installation (553-3001-215)*.

Connections for 500-type telephones and trunks that connect through emergency transfer units are given in Figure 13. A ring ground start button must be provided on these telephones if the trunks are ring ground start.

RPE local and remote carrier shelves are cross-connected to the digital carrier cable pairs as shown in Figures 14 and 15.

RPE maintenance pairs are cross-connected as shown in Figure 16.

Table 3
Cable C designations at local and remote locations

Network loop	Card position	Connector C pin number (Notes 1 and 2)	Lead color	Lead designation
X	9	1	BL-W	C1
X	9	26	W-BL	C2
X	9	2	O-W	C3
X	9	27	W-O	C4
Y	9	3	G-W	C9
Y	9	28	W-G	C10
Y	9	4	BR-W	C11
Y	9	29	W-BR	C12
	9	5	S-W	OWT
	9	30	W-S	OWR
	9	6	BL-R	FLT
	9	31	R-BL	FLR
	4	7	O-R	FLWA
	4	32	R-O	FLWB
	4	8	G-R	WFIT
	4	33	R-G	WFIR
		9 to 25		GND
		34 to 50		GND

Note 1: These leads are grounded in the carrier shelf when cable C is installed in jack C. They are cut off at the main distribution frame (MDF) when cable C goes directly to an MDF. Carrier problems are less likely to occur when the cables terminate directly on the MDF.

Note 2: When cable C goes to an intermediate cross-connect terminal (such as an SL-1 cross-connect terminal), it is terminated at that terminal and extended to the MDF. These leads are then cut off at the MDF.

Table 4
Cable D designations at local and remote locations

Network loop	Card position	Connector D pin number (Notes 1 and 2)	Lead color	Lead designation
X	9	1	BL-W	C5
X	9	26	W-BL	C6
X	9	2	O-W	C7
X	9	27	W-O	C8
Y	9	3	G-W	C13
Y	9	28	W-G	C14
Y	9	4	BR-W	C15
Y	9	29	W-BR	C16
	5	5	S-W	GND
	5	30	W-S	GND
	4	6	BL-R	PFX1
	4	31	R-BL	PFX2
	8	7	O-R	PFY1
	8	32	R-O	PFY2
	9	8	G-R	DCST
	9	33	R-G	DSCR
	9	9	BR-R	DETT
	9	34	B-BR	DETR
		10–25		
		35–50		

Note 1: These leads are grounded in the carrier shelf when cable D is installed in jack D. They are cut off at the main distribution frame (MDF) when cable D goes directly to an MDF.

Note 2: When cable D goes to an intermediate cross-connect terminal (such as an SL-1 cross-connect terminal), it is terminated at that terminal and extended to the MDF. These leads are then cut off at the MDF.

Figure 13
PFT intercabinet and console cross connections (QUA1 shown)

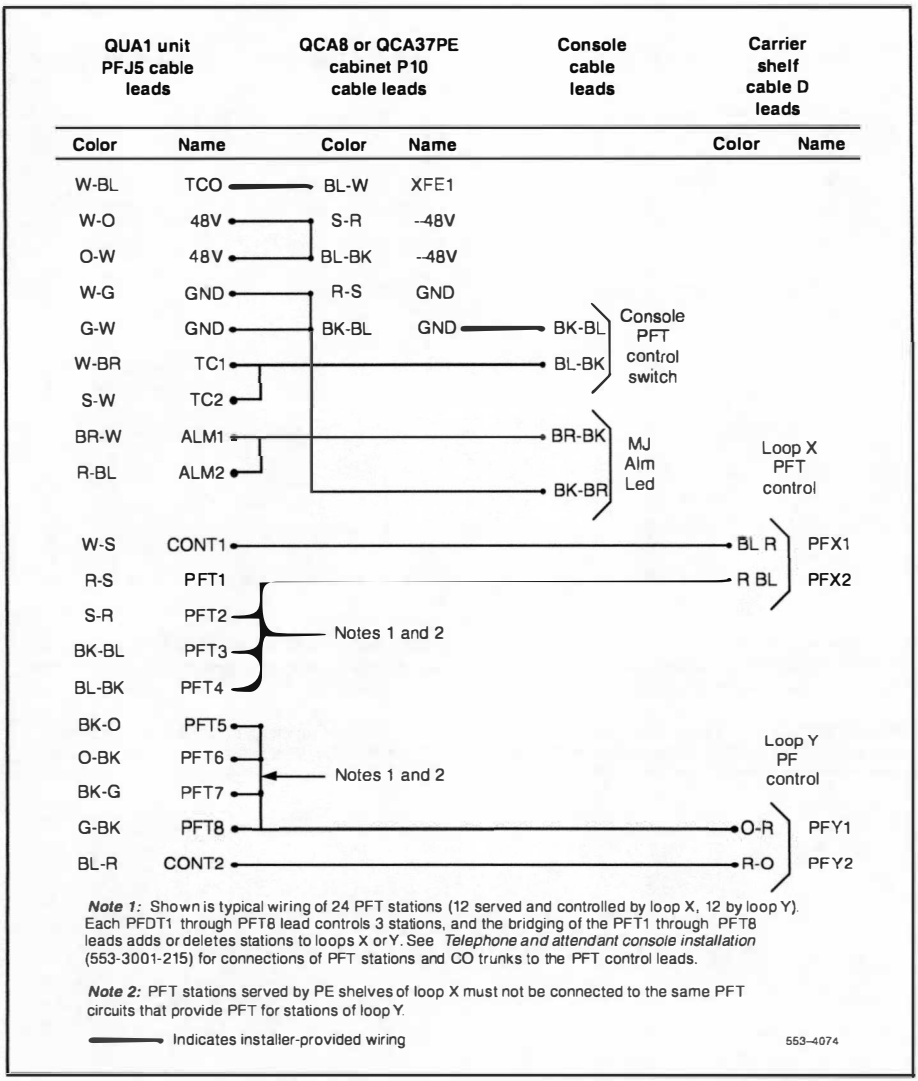


Figure 14
PFT RPE local to remote RPE cross connections

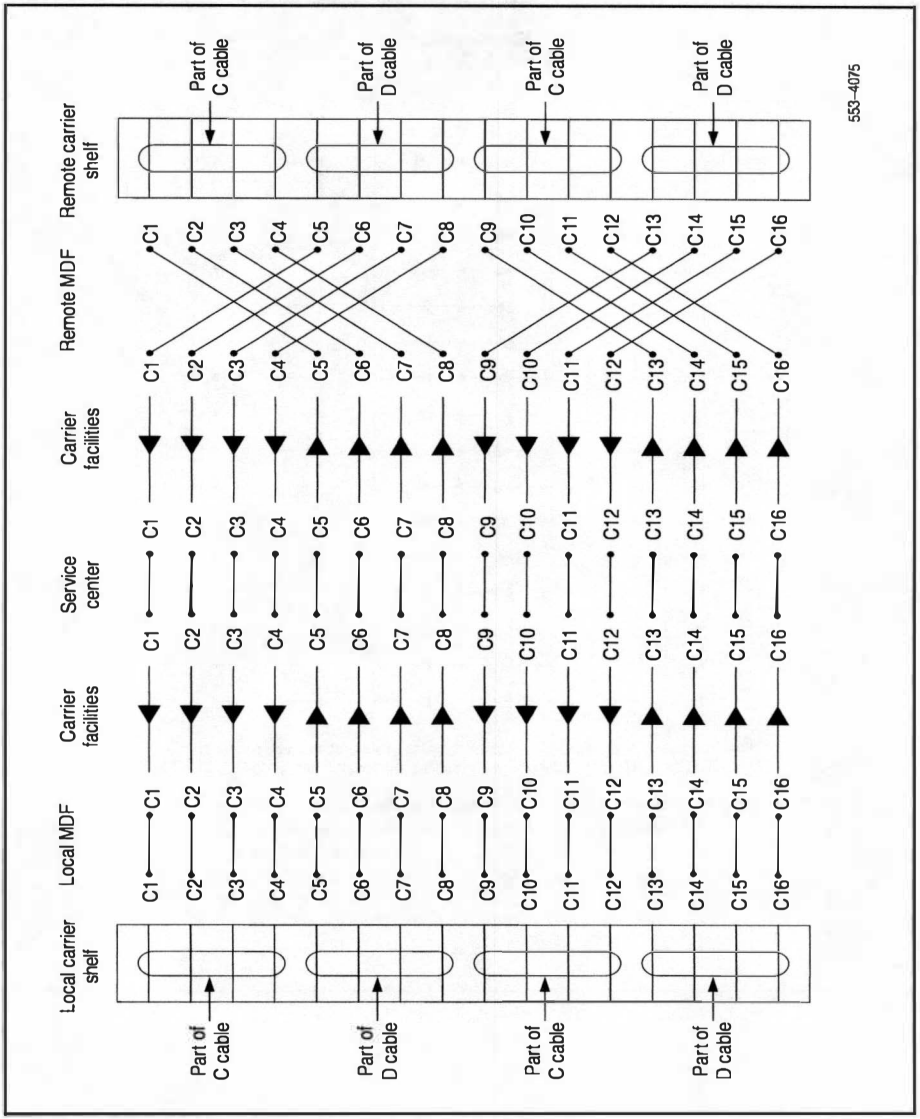
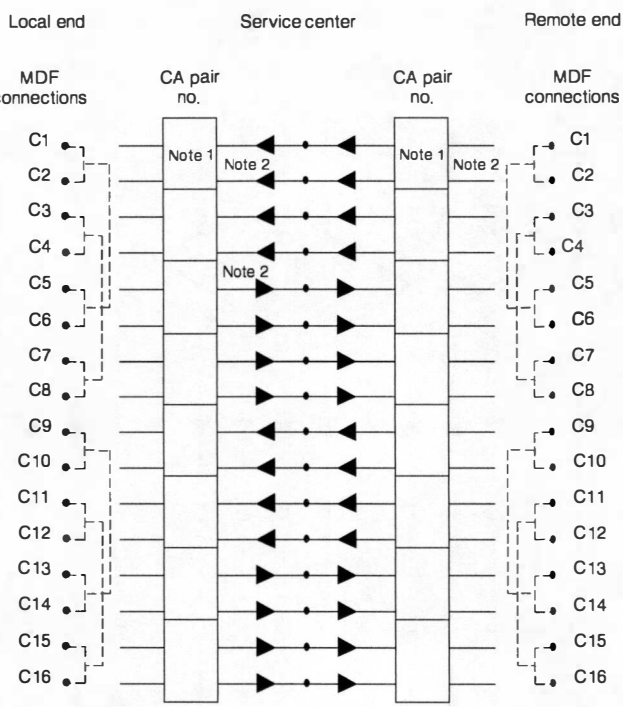


Figure 15
Detail of local and remote MDF cross connections



Note 1: Receiving and transmission cable pairs to be entered in these columns. Obtained from switching center personnel and work order.

Note 2: Indicates transmission to service center from local end.
Indicates receiving from service center at local end.
Indicates receiving from service center at remote end.
Indicates transmission to service center from remote end.

Each set of cable pairs (joined by broken lines) is a separate carrier line (system).

553-5375

Figure 16
Maintenance lead cross connections (Part 1 of 2)

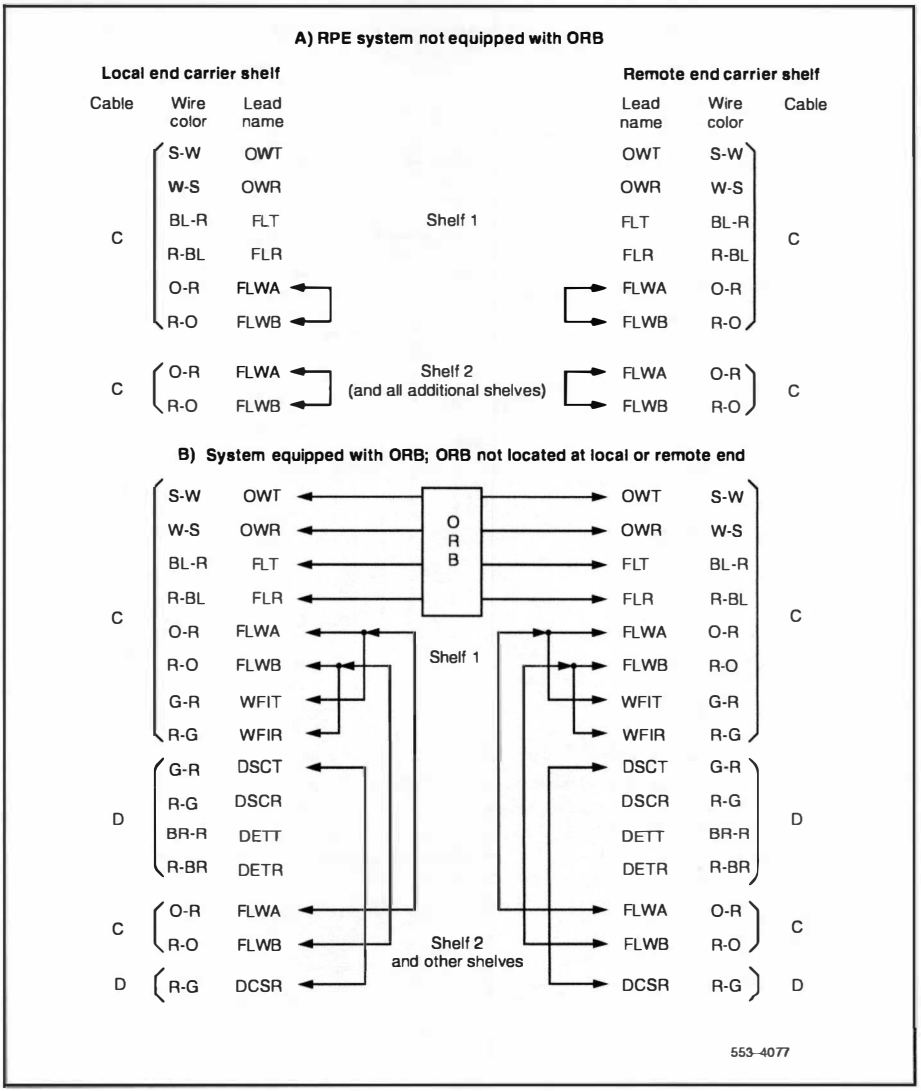
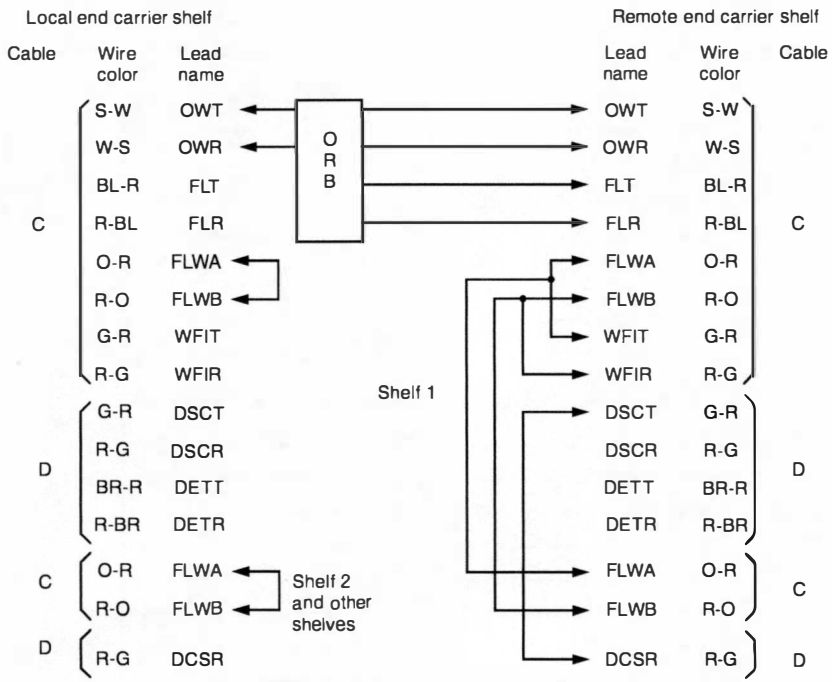


Figure 16
Maintenance lead cross connections (Part 2 of 2)



Note 1: Cross-connections are shown with ORB located at the local end.

Note 2: If ORB is located at the remote end, the cross-connections shown above for the local end are connected at the remote end, and the connections shown for the remote end are connected at the local end.

Note 3: If there is an ORB at the local and remote ends, cross-connections for both ends are the same as shown above for the local end.

Note 4: Diagrams, in parts 1 and 2, assume all the shelves go to the same remote location.

553–5964

Testing

Reference list

The following are the references in this section:

- *X11 features and services (553-3001-306)*

The following identifies the testing information for equipment associated with RPE.

Note: The RPE Diagnostic Program (LD 33) should be included in the midnight routines for any system with RPE.

Network loops

Follow these steps:

1. Load the RPE Diagnostic Program (LD 33) by entering **LD 33**.
2. Enter **LOOP L** (L is the loop number).
3. Response will be **OK** if no faults are detected.
4. Enter **SCAR L** to switch primary carriers on loop L.
5. Enter **LOOP L** again.

   Note: Any connection memory or channel faults detected result in the affected channel being disabled. Refer to LD 30 to interpret outputs.

Telephone, consoles, and add-on modules

For 500 and 2500 telephones, SL-1 telephones, attendant consoles, and add-on modules, refer to *X11 features and services (553-3001-306)*.

Emergency transfer stations and trunks

Follow these steps:

1 Manually invoke an emergency line transfer by operating the emergency transfer switch on the faceplate of the QPC84 card.

2 Perform an outgoing and incoming call to each station.

Note: If outgoing trunks are ring ground start, momentarily operate the ground start button on the 500-type telephone after lifting the receiver to get dial tone.

Transmission quality test

Figure 17 shows the monitoring facility built into the QPC99 Carrier Interface Card. Using these facilities, transmission quality should be tested when the installation is complete.

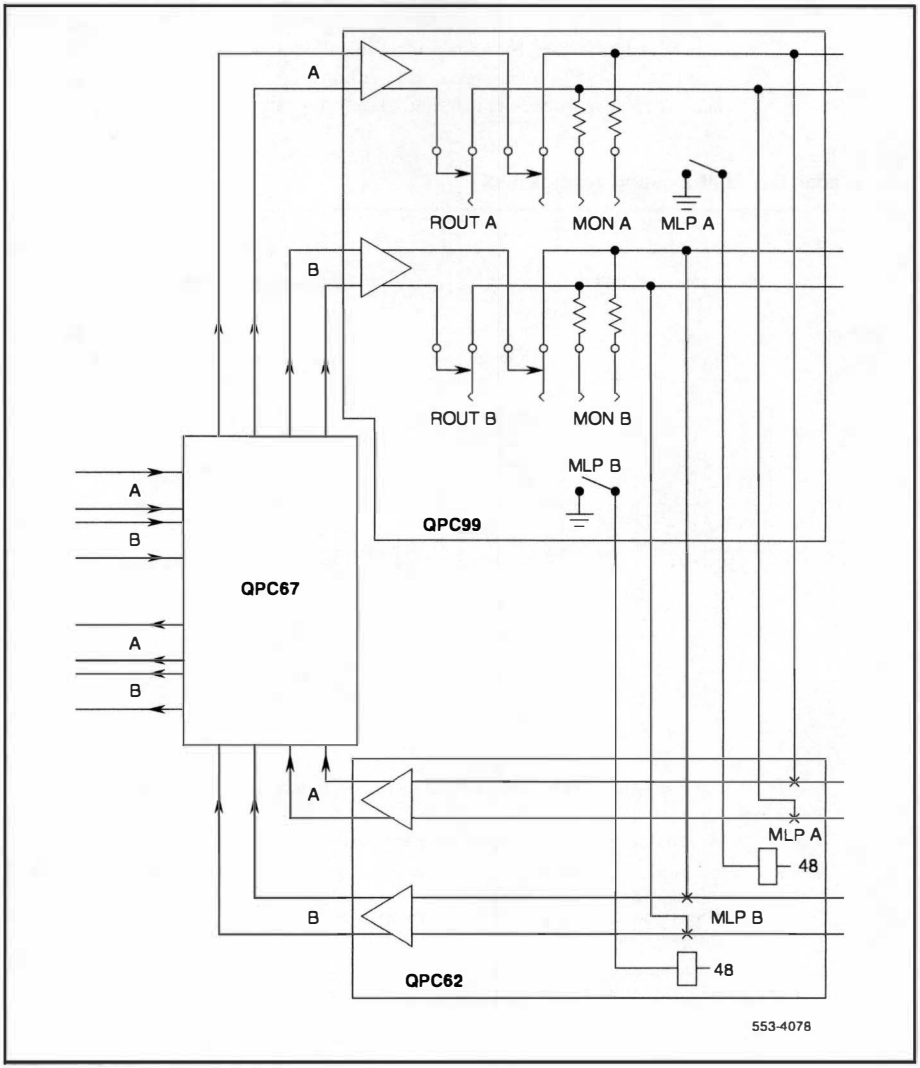
There are two pairs of jacks on the front of the QPC99:

— ROUT A and ROUT B are input jacks for channels A and B, respectively.

— MON A and MON B are output jacks for monitoring the regenerated signal. A test set can be connected to a MON jack at any time to test transmission quality. Connecting a test set to a MON jack does not upset an operating RPE system.

Transmission can be checked by closing the MLP switch at the local end, injecting a test signal at the ROUT jack, and monitoring the output at a remote end MON jack. This checks the transmission path in one direction. The reverse transmission path should be checked in the same way.

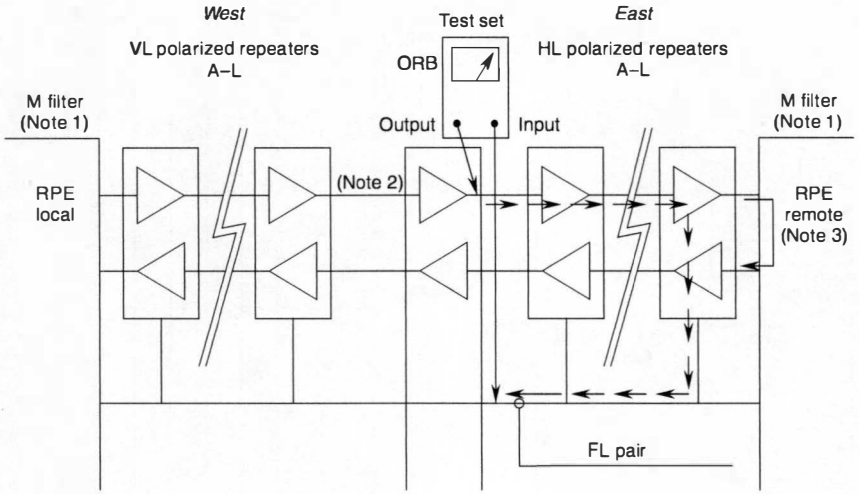
Figure 17
QPC99 maintenance jacks and looping switches



Span line fault locating

The typical repeatered line maintenance arrangement (see Figure 18) includes a series of FL filters and an FL cable pair installed in each span line. One FL filter is used for all repeaters installed in a single housing (with a maximum of 25 two-way repeaters per housing). A filter with a different audio center frequency is installed in each repeater housing in the span line.

Figure 18
Typical span line fault-locating arrangement



Note 1: This is a nonpolarized M filter on the QPC67 card. There must be no M filters within the repeater span.

Note 2: The previous filter must be good for the signal to continue.

Note 3: Loopback conditions, controlled by the QPC99, occur under the following conditions:

- DC on FL pair and TRIOS present
- DC on FL pair and excessive BPV (bipolar violations)
- TRIOS present

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The FL filter is a narrow band selective filter centered at one of 12 audio frequencies. The output of each repeater in the housing is bridged across the input of the respective FL filter. The outputs of all filters in a span are connected to the common FL cable pair. This arrangement permits interrogating each repeater in a span from either span terminal, using a test signal with an audio-frequency component corresponding to the center frequency of the respective FL filter.

When a span line is producing excessive errors or a failure has occurred, it is necessary to locate the defective repeater. An FL test is performed using a Pulse Code Modulation (PCM) line and a repeater test telephone (Lair Seigler Sierra 415A or equivalent). To make the test, the line is removed from service and the test telephone is connected to the line at the span terminal. The output of the test telephone's transmit section is connected to the span line, while the receive section input is connected to the corresponding FL jack.

A series of test pulses with an audio-frequency component is transmitted down the line. The audio-frequency component is selected in turn to correspond to each of the FL filters in the span. This audio-frequency component appears in the output of each repeater in the span. However, a portion of this signal filters through the appropriate associated FL filter and returns to the test telephone over the FL pair. The amplitude of this test signal is measured on the dB meter and is a function of the performance of the repeater under the various test signal conditions. If a repeater has failed completely, no test signal is returned to the test telephone. Changing the audio-frequency component allows each repeater in a span to be tested until the faulty or marginal repeater is located.

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Meridian 1

Remote Peripheral Equipment

Description, installation, and testing

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NORTEL NETWORKS

How the world shares ideas.

Meridian 1

Fiber Remote IPE

Description, installation, and maintenance

Document Number: 553-3001-020
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Standard 4.00. Reissued to remove the DANGER sign because the laser was replaced with an LED. Also *span* is replaced by ***link***.

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Standarde 2.00. Reissued for technical content.

December 1994

Standard 1.00.

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About this document

Reference list

The following are the references in this section:

- *Meridian 1 installation planning (553-3001-120)*
- *Meridian 1 system engineering (553-3001-151)*
- *Meridian 1 power engineering (553-3001-152)*
- *Meridian 1 system installation procedures (553-3001-210)*
- *X11 features and services (553-3001-306)*
- *X11 input/output guide (553-3001-311)*

This document is a supplement to Meridian 1 Nortel Networks technical publications (NTPs). Provides information specific to the Meridian 1 implementation of the Fibre Remote Intelligent Peripheral Equipment (IPE) service.

It describes the operation of the fibre-optic equipment and provides specific information on how to install and maintain this equipment as an integral part of the Meridian 1 system. Fibre Remote IPE configuration procedures are identical to the equivalent non-fibre equipment in Meridian 1. However, there are some additional software commands that can be executed using the Man-Machine Interface (MMI) terminal to specifically control fibre-optic equipment.

The following describes what you will find in this document:

Product description describes the Fibre Remote IPE functional and physical characteristics, general engineering guidelines, and planning and ordering information.

Installation and configuration explains how to prepare the site, how to install fibre-optic equipment at Meridian 1 and Fibre Remote IPE sites, and how to connect the local and the remote sites to the fibre-optic span.

Acceptance testing describes how to perform functional tests to verify that the installed Fibre Remote IPE service is operating correctly.

Maintenance describes how to perform routine administrative and maintenance functions and how to troubleshoot the Fibre Remote IPE equipment and the fibre-optic span connections. It explains how to isolate problems, fix or replace defective equipment, and verify that the equipment is operating correctly after corrections or replacements have been made.

Appendix A lists messages generated by the Meridian 1 CPU and the remote fibre-optic equipment. These messages indicate the status of the equipment and identify a faulty component when problems occur.

This document provides detailed information on how to install, configure, and maintain the fibre-optic equipment; however, it also refers to various Meridian 1 NTPs that contain additional information, which may be required when installing and maintaining the Fibre Remote IPE.

References

The following is a list of documents that are referred to in this document for additional information:

— *Meridian 1 installation planning (553-3001-120)*

— *Meridian 1 system engineering (553-3001-151)*

— *Meridian 1 power engineering (553-3001-152)*

— *Meridian 1 system installation procedures (553-3001-210)*

— *X11 features and services (553-3001-306)*

— *X11 input/output guide (553-3001-311)*

Fibre Remote IPE product description

Reference list

The following are the references in this section:

- *Meridian 1 installation planning (553-3001-120)*
- *Meridian 1 system engineering (553-3001-151)*
- *Meridian 1 system installation procedures (553-3001-210)*

This chapter describes Fibre Remote Intelligent Peripheral Equipment (IPE), its architecture, and its hardware options.

It also describes how to plan and engineer a fibre-optic link.

CAUTION

Use of controls or adjustments, or performance of procedures other than those specified herein may result in hazardous radiation exposure.

WARNING

When working with fibre-optic cables, you must adhere to standard precautions used for optical fibres. Before you can handle optical fibres, you must take necessary training and become certified in working with fibre-optic cables.

System overview

Meridian 1 is a Private Branch Exchange (PBX) that links local subscribers to private and public networks and provides a large number of functions and features.

In addition to supporting local subscribers, Meridian 1 can be configured using Remote IPE modules or small cabinets as a distributed system that supports remote subscribers. They are connected to the PBX at long distances using fibre-optic links.

Subscriber connections at local Meridian 1 IPE Modules are the same as the Remote IPE Modules or small cabinet. The subscriber functions and features at the Meridian 1 are also the same as for the Remote IPE site.

This document focuses on the Meridian 1 PBX and Remote IPE equipment specifically designed to provide fibre-optic links between the network functions in Meridian 1 and the peripheral controller functions in the Remote IPE.

System description

The Fibre Remote IPE provides Meridian 1 functionality with the installation of only IPE Modules and IPE cards at a distant site. The Remote IPE shares Meridian 1 common and network equipment to provide the same functions and features to remote subscribers that are available to local Meridian 1 subscribers.

To explain the implementation of Fibre Remote IPE functions, we will describe:

— Fibre Remote IPE software requirements

— Fibre Remote IPE physical architecture

— Fibre Remote IPE functional architecture

Fibre Remote IPE software requirements

To configure a Meridian 1 system with Fibre Remote superloops in LD 96, you must equip your Meridian 1 system with the Remote_IPE software package 286.

Fibre Remote IPE physical architecture

To configure a Meridian 1 system with Fibre Remote IPE, you can install a floor-standing column or wall-mounted cabinet at a remote site and connect it using fibre-optic links to an existing Meridian 1 system.

New equipment specifically designed to support the fibre-optics interface consists of:

— an NT1P61 Fibre Superloop Network card, which is housed in a Meridian 1 network card slot

— an NT1P62 Fibre Peripheral Controller card, which is housed in the Remote IPE module or cabinet

— NT1P63 Electro-optical interface packlets, installed onto the Fibre Superloop Network card and the Fibre Peripheral Controller card to provide a fibre-optic link between Meridian 1 and Remote IPE

— an optional NT1P63 Electro-optical interface packlet at each site to provide a redundant fibre-optic link

— an NT1P70 wall-mounted cabinet for the remote site

— NT1P75AA fibre-optic patchcords, one for each Electro-optical packlet

— NT1P79AA fibre-optic cable between the fibre management frame and the Fibre Peripheral Controller in the wall-mounted cabinet and the floor-standing column

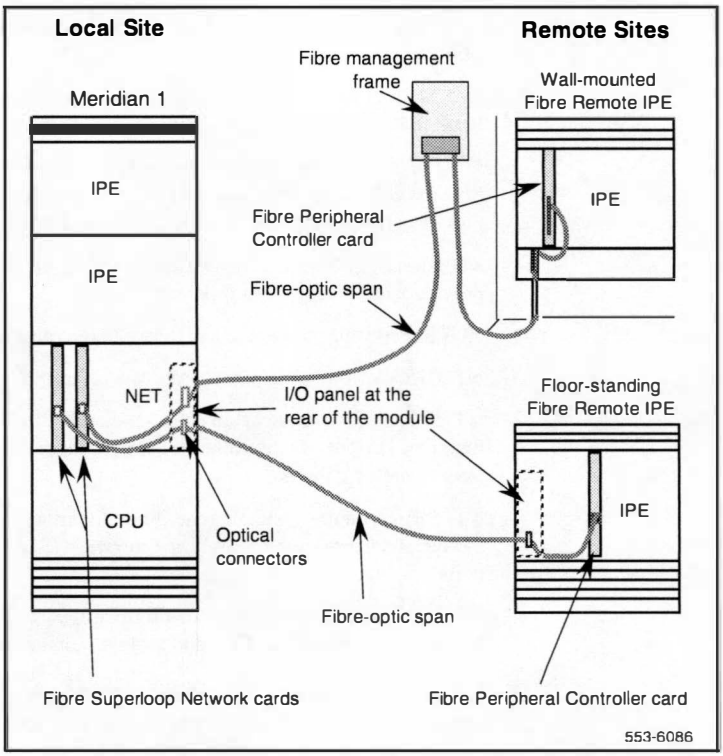
— NT1P76AA cable connecting the Fibre Superloop Network card to the I/O panel and providing Serial Data Interface (SDI) and system monitor ports

— NT1P78AA cable connecting the Fibre Peripheral Controller card to the I/O panel and providing TTY and system monitor ports

Figure 1 illustrates Meridian 1 and Remote IPE equipment linked with fibre-optic cables. The only equipment specifically designed to support this configuration are the cards and the cabinet listed above. All the other equipment is pre-release 20 Meridian 1 hardware.

At the local site, fibre-optic cables contain fibre-optic connectors mounted on the I/O panel connector slots at the rear of the Meridian 1 network module. At the remote site, fibre-optic cable connectors are also installed on the I/O panel connector slots at the rear of the floor-standing Remote IPE module. For the wall-mounted Remote IPE cabinet, the fibre-optic link cable from the fibre management frame is connected directly to the FC/PC fibre-optic connectors of the Electro-optical packlets located on the Fibre Peripheral Controller card.

Figure 1
Meridian 1 to Remote IPE fibre-optic links



Subscriber loops at the Remote IPE are connected to 50-pin connectors on the I/O panel at the rear of the module or at the bottom front of the cabinet as in pre-release 19 hardware. For more details about subscriber connections to Meridian 1 and the Remote IPE, refer to *Meridian 1 system installation procedures (553-3001-210)*.

You can select one of two options for the Remote IPE enclosure:

— Floor-standing Remote IPE module

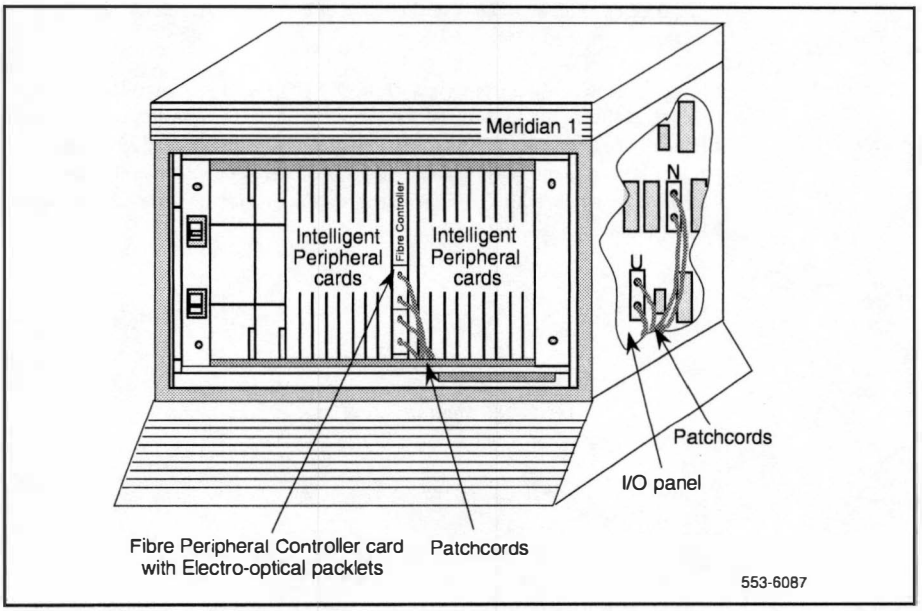
— Wall-mounted Remote IPE cabinet

Floor-standing Remote IPE

The floor-standing Remote IPE comprises a pedestal, one or more IPE Modules, and a top cap. The IPE Module houses a maximum of 16 line cards and a Fibre Peripheral Controller card. The communication and signaling between the Meridian 1 central processing unit (CPU) and the Fibre Peripheral Controller card Micro Processing Unit (MPU) is performed over the fibre-optic link. The fibre-optic link also transmits voice and data information originating and terminating at Remote IPE subscriber stations.

Figure 2 illustrates the front view of the floor-standing Remote IPE column with the cross section of the rear of the module showing the I/O panel. The front view shows the location of the Fibre Peripheral Controller card and the fibre-optic cables that connect the fibre-optic interface on the Fibre Peripheral Controller to the optical I/O panel at the rear of the IPE Module.

Figure 2
Floor-standing Fibre Remote IPE column



Wall-mounted Remote IPE cabinet

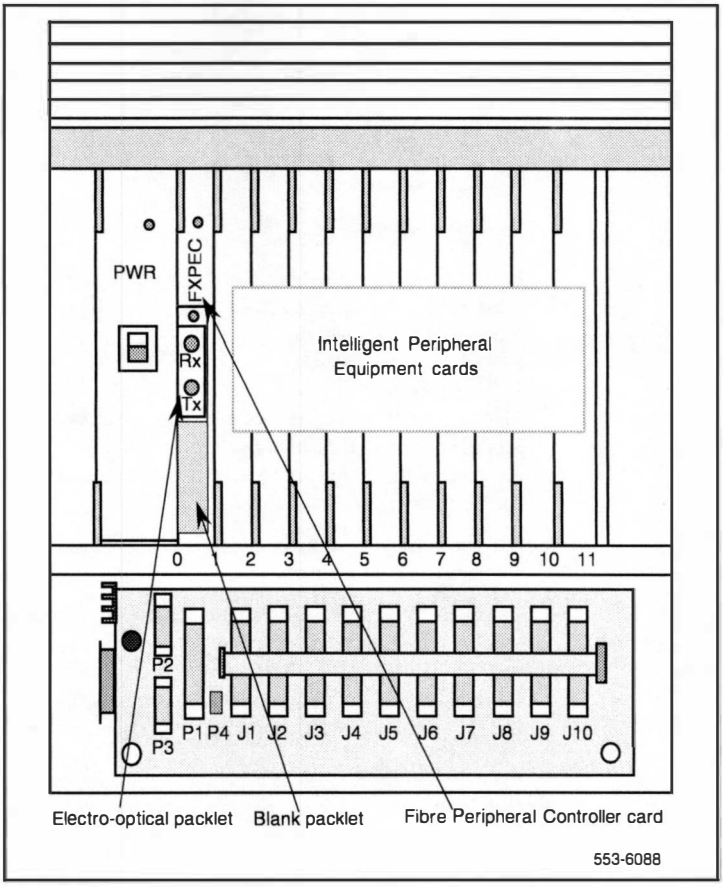
The NT1P70 main wall-mounted Remote IPE cabinet houses a maximum of 10 line cards and a Fibre Peripheral Controller card. The communication and signaling between the Meridian 1 CPU and the Fibre Peripheral Controller card MPU is performed over the fibre-optic link. The fibre-optic link also transmits voice and data information originating and terminating at the Remote IPE subscriber stations.

To expand the number of line cards from 10 to 16, use the first six card slots in the NTAK 12 expansion cabinet. Card slots 7 through 12 in the expansion cabinet are not configurable and must not be used. The expansion cabinet is connected to the Fibre Peripheral Controller card housed in the main cabinet with a cable. This allows the Fibre Peripheral Controller card to control the line cards in both cabinets.

Wall-mounted main and expansion cabinets can be AC- or DC-powered. The power source is directly connected to the shelf power supply for the AC-powered system and to the shelf power converter for the DC-powered system.

Figure 3 illustrates the front view of the NT1P70 wall-mounted Remote IPE cabinet. It shows the location of the Fibre Peripheral Controller card and the Electro-optical packlet on the Fibre Peripheral Controller card. A blank packlet is used in the lower packlet position of the Fibre Peripheral Controller faceplate for a nonredundant link configuration in both the floor-standing IPE Module and the wall-mounted cabinet.

Figure 3
Wall-mounted Remote IPE cabinet



Fibre Remote IPE functional architecture

Fibre Remote IPE functions are controlled by the Meridian 1 CPU and the firmware in the Fiber Superloop Network and Fibre Peripheral Controller cards. The CPU uses software instructions to execute call processing, administration, and diagnostic functions. These functions can be divided into three basic categories:

— CPU functions

— Network functions

— IPE functions

Figure 4 illustrates the Meridian 1 functional architecture in a broad block diagram to show the three basic types of functions and system modules supporting these functions.

CPU functions

Meridian 1 CPU functions are executed by the system software in the CPU Module normally located at the bottom of the Meridian 1 column. The CPU responds to the interrupt requests from the network equipment and the IPE, and performs the following functions:

— controls call origination, call termination, and feature operation for switched voice and data calls

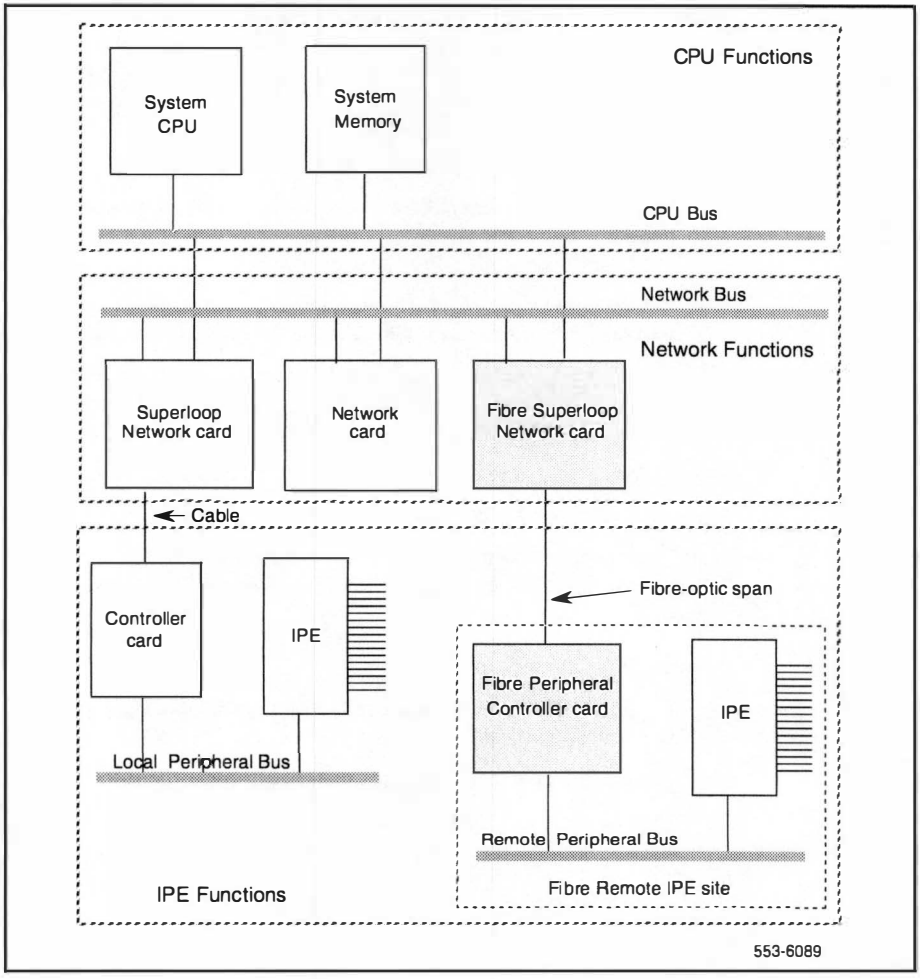
— executes system administration and configuration functions

— coordinates system diagnostic activities

— controls system utility functions such as software loading, initialization, data dumping, traffic logging, and system auditing

Even though the Remote IPE is removed from Meridian 1, the Meridian 1 CPU controls its functions the same way it controls functions of local IPE Modules.

Figure 4
Meridian 1 functional architecture



Network functions

Network switching functions are executed by the equipment housed in Meridian 1 network card slots. The Fibre Superloop Network card is installed in a network card slot. Through its fibre-optic link, it connects to the Fibre Peripheral Controller card installed in the Remote IPE module or cabinet.

These network functions do the following:

— Perform hardware initialization and self-test upon power up

— Establish call connections between the stations connected to Remote IPE line cards and stations local to Meridian 1 or to trunks for long distance trunk calls over public or private networks

— Communicate switching, peripheral signaling, and maintenance information to and from the CPU and the Peripheral Controller MPU

— Monitor fibre-optic link integrity and transmission quality and provide automatic link switching from the failed primary link to the redundant link

— Provide local and remote loopback testing and fault isolation functions

IPE functions

Intelligent peripheral equipment functions are performed by the Fibre Peripheral Controller card and line cards in the Remote IPE Module or cabinet.

These IPE functions do the following:

— Perform hardware initialization and self-test upon Fibre Peripheral Controller power-up

— Assign time slots to line cards to establish call connections

— Communicate with the Fibre Superloop Network card MPU to provide Remote IPE configuration and maintenance functions

— Monitor fibre-optic link integrity and transmission quality and provide automatic link switching from the failed primary link to the redundant link on the Remote IPE side

— ProvideCard-LAN management by polling IPE cards and reporting their status

— Control local stations' ringing functions

— Provide a serial port for local configuration and maintenance functions

— Provide local and remote loopback testing and fault isolation functions

Functional description

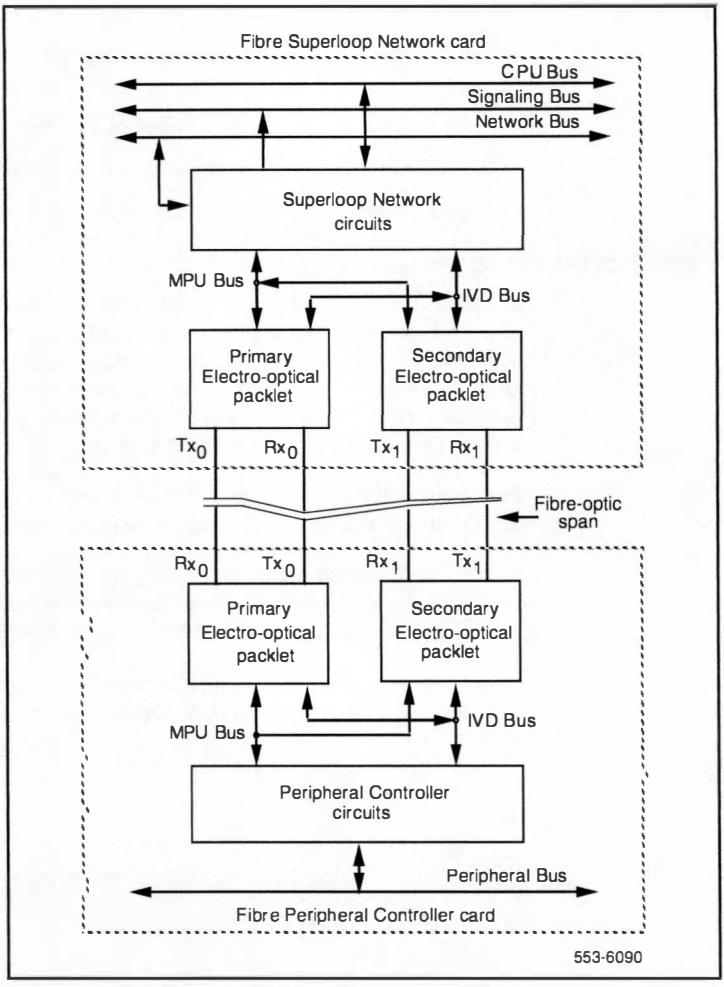
Meridian 1 is controlled by the CPU. The CPU performs read/write functions on the network control and status registers and communicates with the network equipment over the CPU bus. Through these messages, the CPU monitors the system's status, provides call connection sequences, monitors traffic activities, downloads application software and configuration data, and performs system administration and diagnostics.

Fibre Remote IPE utilizes fibre-optic links to provide the same subscriber functionality at the remote site as at the Meridian 1 local site.

Figure 5 illustrates the Meridian 1 Fibre Remote architecture. It shows the Fibre Superloop Network card, the Fibre Peripheral Controller card, and the internal bus structure that connects them to other system components.

Figure 5 also describes the Electro-optical packlet to provide an understanding of the internal system communication and call processing activities through the fibre-optic link.

Figure 5
Meridian 1 Fibre Remote architecture



Fibre Superloop Network card

The NT1P61 Fibre Superloop Network card is a microprocessor-controlled network interface between the Meridian 1 CPU and the remote peripheral equipment. To communicate with the CPU, it uses the network, the signaling, and the CPU buses located in the Meridian 1 network module.

The Fibre Superloop Network card occupies one network card slot and supports four network loops or 128 time slots; 8 for signaling and 120 for voice and data transmission with the Fibre Peripheral Controller card. The Electro-optical packlet mounted on the Fibre Superloop Network and Fibre Peripheral Controller cards provide a dedicated link between these two cards.

The main Fibre Superloop Network card performs the following functions:

— Provides a single or a redundant dedicated optical link to connect the Remote IPE to Meridian 1

— Assigns any network time slot to any time slot available on the fibre-optic link to support peripheral equipment time slot assignments

— Supports eight signaling channels for Common Channel Signaling (CCS) in servicing Scan and Signal Distributor (SSD) messages, card maintenance, and card enable messages

— Provides an interface for system power and alarm monitoring

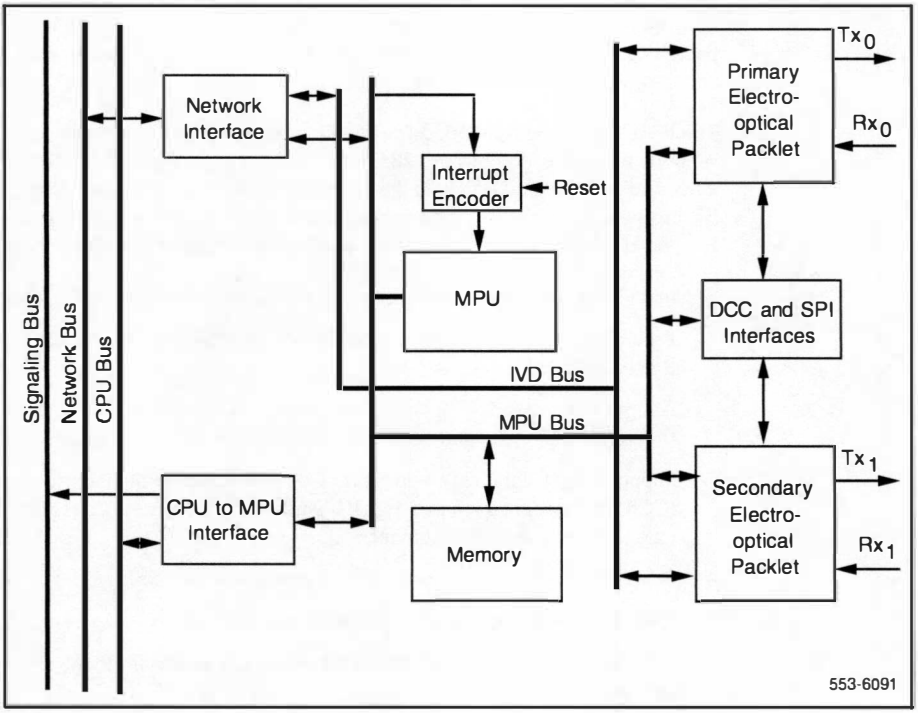
— Provides an interface for a maintenance port

— Provides continuity test pattern generation and detection for loopback testing

— Performs diagnostic self-tests during power-up and when requested by the CPU

Figure 6 shows the Fibre Superloop Network card block diagram illustrating major functional blocks.

Figure 6
Fibre Superloop Network card functional block diagram



Micro Processing Unit (MPU)

The MPU coordinates and controls data transfer and the addressing of peripheral devices and communicates with the Meridian 1 CPU using a message channel on the CPU bus. The tasks the MPU performs depend on the interrupts it receives. These interrupts are prioritized by the importance of the tasks they control.

The MPU is highly integrated and provides most of the decision making logic on the chip. These include controllers, timers, control and arbitration logic, address decoding, dual port RAM and independent direct memory access, parallel input/output ports, and three independent full duplex serial communication channels that support various protocols and a synchronous SPI interface.

The MPU can be reset by:

— powering up the Fibre Superloop Network card

— the watchdog timer

— the ENB/DIS switch

— the Meridian 1 CPU command

Memory

The Fibre Superloop Network memory stores programs and data for the following functions in the following locations:

— Boot code and self-test code are stored in the EPROM.

— Data is stored in the RAM.

— The main function code is stored in the Fibre Superloop Network card FLASH memory.

— Data containing the Fibre Superloop Network card identification and version is stored in the EEPROM.

CPU to MPU bus interface

Information exchange between the Meridian 1 CPU and the Fibre Superloop Network MPU is performed with packetized messages transmitted over the CPU bus.

This interface uses shared static random access memory (SRAM) as a communication exchange point between the CPU and the MPU. Both the CPU and the MPU can access this memory over the transmit and receive channels on the CPU bus.

Network bus interface

The network bus interface performs two major functions:

— Converts bit interleaved serial data received from the network bus into byte interleaved data for transmission over the 128 time slots used by the IVD bus

— Accepts byte interleaved data transmitted from the IVD bus and converts it into a bit interleaved data stream for transmission over the network bus

Fibre-optic interface

Two NT1P63 Electro-optical packlets can be installed on each Fibre Superloop Network card to provide redundant fibre-optic interfaces, or the Fibre Superloop Network card can be equipped with only one Electro-optical packlet for a nonredundant link. The fibre-optic interface provides a 155.52 Mbps point-to-point transmission facility.

The fibre-optic interface performs the following functions:

— Connects Meridian 1 to Remote IPE using a dedicated single mode fibre-optic link

— Provides a synchronous communication channel between the Fibre Superloop Network card MPU and the Fibre Peripheral Controller card MPU

— Uses one or, optionally, two Electro-optical packlets installed on the Fibre Superloop Network card to provide redundant fibre-optic links

— Uses buffers and transceivers to extend the MPU data, address, and control buses to the Electro-optical packlet

— Provides Electro-optical packlet version identification, which is stored in the packlet's EEPROM

— Monitors transmission quality of the fibre-optic link; if the transmission is degraded or fails, the Fibre Superloop Network card automatically transfers to the redundant link, if equipped.

Fibre Peripheral Controller card

The NT1P62 Fibre Peripheral Controller card is a microprocessor controlled peripheral interface between the Fibre Superloop Network card and the Remote IPE line cards. To communicate with the Fibre Superloop Network card, the Fibre Peripheral Controller card uses the Electro-optical interface and the fibre-optic link. To communicate with the peripheral equipment, the Fibre Peripheral Controller uses 16 full duplex serial loops, one for each line card in the IPE Module.

The Fibre Peripheral Controller card occupies one card slot in the IPE Module. The adjacent card slot is not the full width and must remain empty; however, a dummy faceplate should be installed in this empty card slot to provide a better air flow between cards. This is necessary because a non-fibre Peripheral Controller card occupies two card slots in the IPE Module and the Fibre Peripheral Controller card that plugs into the same card slot occupies only one card slot. The dummy faceplate is used in the floor-standing IPE Module but is not necessary in the wall-mounted IPE cabinet.

The main Fibre Peripheral Controller card performs the following functions:

— Provides a single or redundant dedicated optical link to connect the Remote IPE to Meridian 1

— Assigns any of the 120 time slots on the fibre-optic link to any time slot of the 16 full duplex serial loops assigned to line cards in the IPE Module

— Converts the SSD-type signaling format received from the Fibre Superloop Network card to the signaling format for digital telephone sets, and from digital telephone sets format to SSD-type format

— Polls telephone sets to determine the set type and its signaling protocol and transmits this information to the Fibre Superloop Network card

— Supports CCS protocol between the Fibre Superloop Network and the Fibre Peripheral Controller cards

— Provides an interface for a maintenance port

— Provides a Card-LAN port

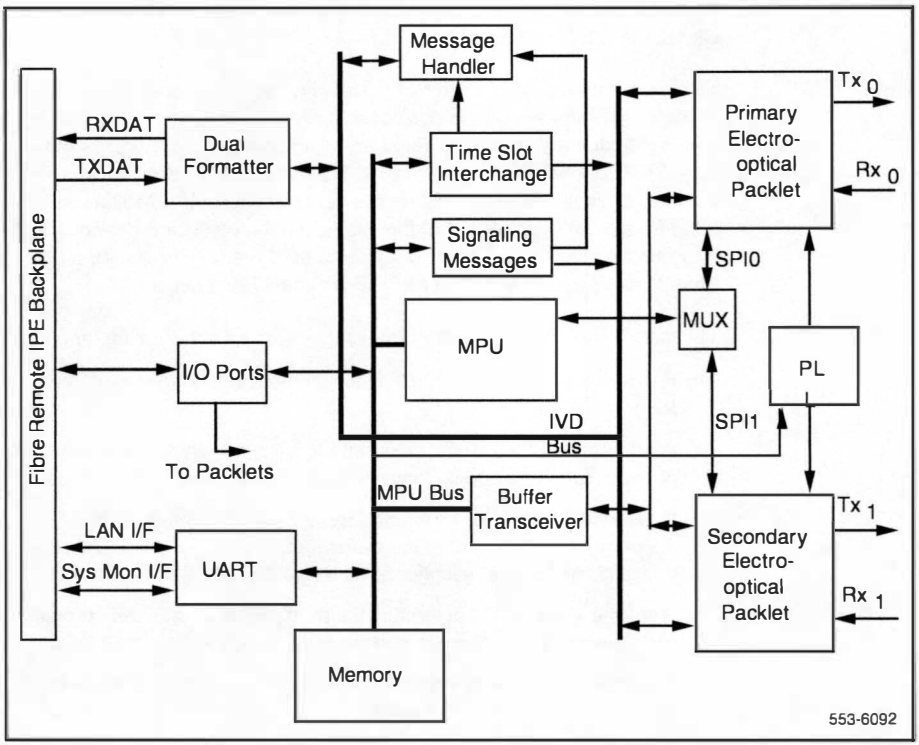
— Provides continuity test and line card polling, enabling, and disabling

— Provides an interface for system power and alarm monitoring

— Performs diagnostic self-tests during power-up and when requested by the CPU

Figure 7 shows the block diagram of the Fibre Peripheral Controller card which illustrates major functional blocks. Functions of these blocks are described below.

Figure 7
Fibre Peripheral Controller card functional block diagram



Micro Processing Unit (MPU)

The MPU coordinates and controls data transfer and the addressing of peripheral devices and communicates with the Fibre Superloop Network card using serial communication channels. In addition, the MPU has a special communication channel used to communicate with the microcontroller on one Electro-optical packlet at a time. The tasks the MPU performs depend on the interrupts it receives. These interrupts are prioritized by the importance of tasks they control.

The MPU is highly integrated and provides most of the decision-making logic on the chip. Functions on the MPU include controllers, timers, control logic, address decoding, dual port RAM and independent direct memory access, parallel input/output ports, and three independent full duplex serial communication channels that support various protocols.

The MPU can be reset by:

— powering up the Fibre Peripheral Controller card

— the watchdog timer

Memory

The Fibre Peripheral Controller memory stores programs and data for the following functions in the following locations:

— Boot code and self-test code are stored in the EPROM.

— Data is stored in the RAM.

— The main MPU function code is stored in the Fibre Peripheral Controller card FLASH memory.

— Data containing the Fibre Peripheral Controller card identification and version is stored in the EEPROM.

Card-LAN interface

To implement the Card-LAN interface, the Fibre Peripheral Controller card uses a dual UART device. One UART channel provides a serial communication interface to IPE cards.

The Card-LAN is a 19.2 kbps asynchronous interface. It is used to poll and communicate with IPE cards through the Fibre Peripheral Controller to transmit maintenance messages, which include:

— LED control of the IPE card enable/disable

— peripheral card configuration

— peripheral card type and version information

IPE interface

The IPE interface links IPE cards to the Fibre Peripheral Controller MPU using sixteen DS-30X loops, one for each IPE card. It contains the following Fibre Peripheral Controller circuits:

— Dual formatter that transforms serial peripheral loop information into parallel Integrated Voice and Data (IVD) bus information and parallel IVD bus information to serial peripheral loop information.

— Message handler that performs channel associated signaling to and from the IPE cards. It receives signaling information from the IPE cards, and then the MPU accesses this information, interprets it, and sends it to the Fibre Superloop Network in the appropriate format. From the Fibre Superloop Network, the signaling messages are received and interpreted by the Fibre Peripheral Controller MPU and sent to the serial peripheral loops in the appropriate format.

— Time slot interchange that provides the correspondence between the 120 voice and data time slots on the fibre-optic link and the 640 time slots on the IVD bus. The time slots on the IVD bus correspond directly to the peripheral line card loops.

— Common channel signaling that handles the SSD signaling to and from the Fibre Superloop Network card. It receives signaling packets from Fibre Superloop Network, checks for CRC errors, strips start/stop bits and sends the rest of data to the Fibre Peripheral Controller MPU for processing. It also processes the signaling information in the opposite direction by receiving the messages from the MPU, adds CRC and start/stop bits, and transmits these as SSD messages to the Fibre Superloop Network over the fibre-optic link.

Fibre-optic interface

Two NT1P63 Electro-optical packlets can be installed on each Fibre Peripheral Controller card to provide redundant fibre-optic interfaces. The Fibre Peripheral Controller card can be equipped with only one Electro-optical packlet for a nonredundant link operation. The fibre-optic interface provides a 155.52 Mbps point-to-point transmission facility.

The fibre-optic interface performs the following functions:

— Connects Meridian 1 to Remote IPE using a dedicated single mode fibre-optic link

— Provides a synchronous communication channel between the Fibre Superloop Network card MPU and the Fibre Peripheral Controller card MPU

— Uses buffers and transceivers to extend the MPU data, address, and control buses to the Electro-optical packlet

— Uses one or, optionally, two Electro-optical packlets installed on the Fibre Peripheral Controller card to provide redundant fibre-optic links

— Provides Electro-optical packlet version identification, which is stored in the packlet's EEPROM

— Monitors transmission quality of the fibre-optic link; if the transmission is degraded or fails, the Fibre Peripheral Controller card automatically transfers to the redundant link, if equipped

Engineering guidelines

Meridian 1 general system engineering guidelines are described in *Meridian 1 system engineering (553-3001-151)*. The following information deals specifically with engineering guidelines for the Fibre Remote IPE planning and implementation. It also describes the fibre-optic interface specifications and fibre-optic link characteristics.

Fibre Remote IPE capacity

Meridian 1 physical capacity depends on the system's configuration and size. System options 21E, 51, 51C, 61, 61C, 71, 81, and 81C are designed to provide port capacities from tens to thousands of ports. These ports are normally local to Meridian 1, however, by implementing Fibre Remote IPE, some of these ports can be located at one or more remote sites.

The overall system capacity does not change by installing Fibre Remote IPE. The difference between the Meridian 1 system with Fibre Remote IPE and without Fibre Remote IPE is the distribution of the line cards, that is, the subscriber loops. Fibre Remote IPE allows you to distribute the peripheral equipment at long distances from Meridian 1 and provide the same functions and features to remote subscribers as to local subscribers.

> ***Note:*** System capacity may be affected by the capacity of the Fibre Superloop Network card, which supports only one IPE Module instead of the two IPE Modules supported by the Superloop Network card.

The Fibre Remote IPE capacity can be tailored according to port capacity requirements at the remote site. When planning a Fibre Remote IPE site, you must determine the number of IPE cards required to support the existing and future traffic needs. Based on these requirements, two Fibre Remote IPE hardware options are available:

— Floor-standing Remote IPE column

— Wall-mounted Remote IPE cabinet

Floor-standing Fibre Remote IPE

The floor-standing Fibre Remote IPE consists of the Meridian 1 pedestal, IPE Module, and a top cap. One IPE Module supports up to 16 line cards, or 256 ports if each line card has 16 ports. If more ports are required, additional IPE Modules can be added to the column. A column contains a maximum of four modules. Each IPE Module requires one Fibre Peripheral Controller card located in the IPE Module and a corresponding Fibre Superloop Network card located in a Meridian 1 network card slot.

> ***Note:*** In a Meridian 1 column, a Superloop Network card can support up to two IPE Modules. However, in a Meridian 1 system with the Fibre Remote IPE configuration, a Fibre Superloop Network card supports only one Remote IPE Module. This is due to the dedicated fibre-optic link configuration between the Fibre Superloop Network card and the Fibre Peripheral Controller card. Since fibre-optic links are dedicated, they cannot be shared between two different IPE Modules at the remote site.

Wall-mounted Fibre Remote IPE

The wall-mounted Fibre Remote IPE consists of NT1P70 main and NTAK12 expansion cabinets. The main cabinet supports the Fibre Peripheral Controller card and up to 10 IPE cards or 160 ports. If more ports are required, an expansion cabinet can be installed adjacent to the main cabinet.

These two cabinets are linked with an inter-cabinet cable that plugs into P1 50-pin connectors located at the bottom left-hand corner of each cabinet. This cable extends six peripheral bus DS-30X loops to the first six IPE card slots in the expansion cabinet. One Fibre Peripheral Controller card located in the main cabinet supports cards in both main and expansion cabinets as long as the expansion cabinet contains no more than 6 IPE cards installed in the first six IPE card slots.

Engineering the fibre-optic link

A fibre-optic link can be constructed using single-mode or multi-mode fibre-optic cables. The type of fibres you select will depend on various factors:

— distance between Meridian 1 and the Fibre Remote IPE site

— possible existence of a fibre-optic link you wish to use for this application

— cost, availability, and so on

When engineering a fibre-optic link, you must consult the component manufacturer's data sheets to determine whether the cable, connectors, and other components meet the transmission characteristics and the signal loss plan for the transmission distance required for your specific Fibre Remote IPE application.

Fibre-optic bandwidth

When using a single-mode fibre, the optical link transmission distance is strictly loss-limited and not dispersion limited. When using multi-mode fibre, the transmission distance will be loss and dispersion limited. Appropriate calculations must be made to determine the maximum link distance. The data rate over the multi-mode fibre is limited by the optical bandwidth of this multi-mode fibre. The bandwidth is defined as the frequency at which a sinusoidal signal is attenuated by 3 dB relative to a DC signal.

For the Fibre Remote IPE, the bandwidth is defined to be 1310 nanometers. The bandwidth-length product for single-mode is 5 GHz km and for the graded index multi-mode is 800 MHz km.

When you engineer a fibre-optic link, you must make sure that the total signal attenuation between the Fibre Superloop Network and the Fibre Peripheral Controller Electro-optical interfaces does not exceed 13 dB loss.

> *Note:* If the fibre-optic link already exists, check the link's characteristics and end-to-end loss to determine if it can support a Fibre Remote IPE and, if it can, at what distance between Meridian 1 and the Fibre Remote IPE.

Bandwidth engineering rules

The eye closure due to dispersion must not exceed 0.5 dB to ensure reliable operation of the Electro-optical packlets. Based on this, the normalized bandwidth (B_N) must not be less than 0.71.

The maximum fibre length for a link can be calculated by the following equation, where **L** is the fibre-optic link length, $\mathbf{B_L}$ is the bandwidth-length product, $\mathbf{B_T}$ is the NRZ bit rate of 155.52 MHz, and $\mathbf{B_N}$ is the maximum allowable optical bandwidth of 0.71 when normalized to the above bit rate.

$$L = \frac{B_L}{B_T x B_N}$$

To engineer a multi-mode fibre link, use the following steps:

1 Obtain bandwidth-length product of the fibre from the manufacturers' data sheet.

2 Calculate the maximum link length using the above equation.

3 Measure the eye closure of the fibre. When measured at 155.52 MHz and 1310 nanometers it should be less than 0.5 dB.

4 Measure the attenuation of the fibre link. When measured at 1310 nanometers the attenuation should not exceed 10 dB.

Example: A maximum link length of a multi-mode fibre link with bandwidth-length product of 500NHz km would be:

$$L = \frac{500 MHz km}{155.52 MHz x 0.71} = 4.53 km$$

This multi-mode fibre link should not exceed 4.53 kilometers in length. A 3 dB safety margin should be allowed when engineering a multi-mode link to compensate for additional attenuation as a result of core size variations in fibers. The single-mode fibre core size varies between 8 and 9 microns and the multi-mode fibre core size varies between 50 and 62.5 microns.

Fibre-optic interface specification

When planning a fibre-optic link, you must consider the transmit and receive signal power and the signal attenuation of each component in the link to determine total signal attenuation.

Table 1 shows the transmit and receive signal power level at the signal source and the signal destination. In the table, for simplicity use **FXNET** for Fibre Superloop Network and **FXPEC** for Fibre Peripheral Controller cards. The receive circuit on the Electro-optical packlet must be able to detect a signal at a level as low as –28 dBm.

Table 1
Fibre-optic transmit and receive signal levels

Signal source	Transmitted power		Received power	
	Min	Max	Min	Max
FXNET Card	–15 dBm	–8 dBm	–28 dBm	–8 dBm
FXPEC Card	–15 dBm	–8 dBm	–28 dBm	–8 dBm

Fibre-optic link loss characteristics

The fiber-optic link components add to the total end-to-end link signal attenuation. The fibre-optic cable attenuation depends on the type of cable selected. The manufacturer's data sheet provides necessary parameter values, which must be considered when engineering the link. In addition, the signal attenuation is also affected by the number of splices in the link and the signal loss in the link terminating the fibre-optic connectors.

Table 2 shows an example of different fibre-optic link components and the total signal attenuation for a 10 km link of 11.2 dB.

Table 2
Example of fibre-optic link components and their attenuation factors

Component	Quantity	Attenuation in (dB)	Total attenuation in (dB)
Fibre (10 km)	1	0.6/km	6.0
Splices	10	0.2/splice	2.0
FC/PC Connectors	4	0.8/connector	3.2

Maximum calculated signal attenuation across the link is 12 dB, which allows 1dB safety margin.

> ***Note:*** Actual attenuation must be determined from specific manufacturer's data sheets for each link component.

Fibre-optic cable handling considerations

Fibre-optic cable selection, installation, and routing require special considerations. Splices and connector contacts represent discontinuities that contribute to the attenuation of the signal as it propagates through the link.

Routing the fibre-optic cable must be considered with care. The most critical routing areas are tight spots where the cable must be bent. When bending a cable you must make sure that the minimum bending radius of 1.4 inches (3.5 cm) is not exceeded. If the cable is bent tighter than the minimum radius, the attenuation increases and the cable may break or become damaged.

Before you start routing and splicing fibre-optic cables, read the cable specification sheet and adhere to the specified installation rules.When handling optical fibres, follow the safety recommendations at all times. Keep all connectors capped while the cables are disconnected.

WARNING

When handling optical fibers, follow the recommended safety procedures at all times.

Before you can handle optical fibres, you must take necessary training and become certified in working with fibre-optic cables.

Cable types and their terminations

Single-mode fibres and fibre-optic connectors allow only one path for light to propagate because of the small diameter of the fibre. These are used for high speed transmission and longer transmission distances. Multi-mode fibres and fibre-optic connectors allow more than one mode of propagation for a specific wavelength. These cause dispersion of light and limit the effective bandwidth and distance of communication. For the Fibre Remote IPE, Nortel Networks recommends single-mode fibre-optic cables.

If a multi-mode fibre-optic link already exists, it must be evaluated to determine if it will support the Fibre Remote IPE application and, if it will, at what distance from Meridian 1. The distance of the link can be determined by finding a point of the fibre-optic link where the signal loss is less than 13 dB for a given transmission rate.

To evaluate an existing link, contact your Nortel Networks distributor to learn the method and instrumentation required to test the link's suitability for the Fibre Remote IPE application.

A fibre-optic link may be composed of single-mode or multi-mode fibres, splices, and fibre-optic connectors. In a floor-standing Fibre Remote IPE, the fibre-optic link terminates at the optical I/O panel FC/PC fibre-optic connectors. In a wall-mounted Fibre Remote IPE cabinet, the fibre-optic link terminates at the fibre management frame and continues from the fibre management frame to the Electro-optical packlet FC/PC fibre-optic connectors installed on the Fibre Peripheral Controller card. In both cases, FC/PC fibre-optic connectors have to be installed onto fibres of the link so that the link can be directly connected to the FC/PC fibre-optic connectors of the Fibre Remote IPE.

System planning and ordering

Meridian 1 provides the user with a variety of system sizes and features. To select a system that will best suit your current and future communication needs, you must plan carefully. Contact your Nortel Networks representative or your Nortel Networks distributor to help you plan the system.

If you are installing a new Meridian 1 with Fibre Remote IPE, refer to *Meridian 1 installation planning (553-3001-120)* and *Meridian 1 system engineering (553-3001-151)* for overall system information. To obtain specific planning and ordering information for the fibre-optic link and network and peripheral cards interfacing with this link, follow the information below.

If you have an existing fibre-optic link, you must evaluate it to determine if the link characteristics such as loss, fibre-optic mode, and so on, can support a Fibre Remote IPE. You also must evaluate the distance between Meridian I and the Fibre Remote IPE—the link loss should not exceed 13 dBs.

System selection

Determine the type of Fibre Remote IPE enclosure. This selection may be dictated by the installation preference, blocking considerations, and the number of IPE cards required at the remote site.

If you plan a floor-standing system, you must select the Meridian 1 modular column. If you plan a wall-mounted system, you must select the cabinet.

In some applications where non-blocking or low blocking traffic considerations are important, you have to limit the number of peripheral cards supported by each Fibre Peripheral Controller card. For a non-blocking condition, the 120 voice/data time slots will support seven or eight 16-port line cards. Each additional line card in the IPE Module or the wall-mounted cabinet increases call blocking under high traffic conditions. Refer to *Meridian 1 system engineering (553-3001-151)* to calculate traffic.

The system type may also be dictated by the number of ports required at the remote site. The modular column configuration supports 16 line cards and provides a maximum of 256 ports. This column may be expanded by adding a second IPE Module to support an additional 256 ports. Each IPE Module requires a Fibre Peripheral Controller card at the remote site and a corresponding Fibre Superloop Network card at the local Meridian 1 site.

In addition to line cards, the Fibre Remote IPE supports all the cards that do not require external connection to Meridian 1 common or network equipment.

The wall-mounted configuration supports 10 line cards. You may want to select the wall-mounted system if your system size requirement is less then ten IPE cards. To expand this type of system beyond 10 IPE cards, you must add an expansion cabinet adjacent to the main cabinet and install up to six IPE cards into the first six IPE card slots of the expansion cabinet.

Fibre Remote IPE site planning

When you select a site for your Fibre Remote IPE, you must consider the number of ports currently required at the site and the possibility of expansion to meet future needs. You also must consider environmental, power, and cable routing requirements.

Environmental requirements

Fibre Remote IPE equipment conforms to the same environmental requirements as the rest of the Meridian 1 equipment. Temperature, humidity, and altitude for Meridian 1 equipment operation should not exceed the specifications shown in Table 3.

Table 3 shows the operating and storage environmental specifications. Ideally Meridian 1 equipment should operate in a stable environment at 22° C (72° F); however, the system is designed to operate in the temperature and humidity ranges specified in the table.

Table 3
Environmental requirements

Condition	Environmental specifications
Operating	
Temperature	0° to 60° C (32° to 140° F)
Relative humidity	5% to 95% noncondensing
Altitude	3,048 meters (10,000 feet) max
Storage	
Temperature	–50° to 70° C (–58° to 158° F)
Relative humidity	5% to 95% noncondensing

Power requirements

At the remote site, cards in the IPE Module are powered by the power supply installed on the left-hand side of the IPE Module. The power consumption of the Fibre Peripheral Controller card is not significantly different from the power consumption of the standard Peripheral Controller card. This allows the standard IPE Module's power supply to be used in Fibre Remote IPE.

Similarly, the wall-mounted cabinet power supply, which is installed in the left-hand side of the cabinet shelf, provides power to the Fibre Peripheral Controller card and up to 10 IPE cards. The expansion cabinet requires its own power supply to provide power to an additional six IPE cards.

Table 4 shows the power supply DC output voltages and the current they supply to the Fibre Superloop Network and Fibre Peripheral Controller cards in a redundant and nonredundant fibre-optic link configuration. It also shows the corresponding total power consumption for each card.

Table 4
FXNET and FXPEC with single and dual Electro-optical packlets power requirements

Voltage source in VDC	Nonredundant link		Redundant link	
	FXNET card	FXPEC card	FXNET card	FXPEC card
+5 V	2100 mA	1700 mA	2300 mA	1900 mA
–4.5 V	650 mA	650 mA	1300 mA	1300 mA
+15 V		50 mA		50 mA
–15 V		50 mA		50 mA
+12 V	50 mA		50 mA	
–12 V	50 mA		50 mA	
Total Power	14.6 W	13 W	20 W	18.5 W

Fibre-optic cable requirements

A fibre-optic link may be composed of single-mode or multi-mode fibres, splices, and fibre-optic connectors. In a floor-standing Fibre Remote IPE, the fibre-optic link terminates the optical I/O panel FC/PC fibre-optic connectors. In a wall-mounted Fibre Remote IPE cabinet at the fibre-optic link terminates at the a fibre management frame and continues from the fibre management frame to the Electro-optical packlet FC/PC fibre-optic connectors installed on the Fibre Peripheral Controller card. In both cases, FC/PC fibre-optic connectors have to be installed onto fibres of the link so that the link can be directly connected to the FC/PC fibre-optic connectors of the Fibre Remote IPE.

> ***Note:*** Single-mode fibres and fibre-optic connectors allow only one path for light to propagate because of the small diameter of the fibre. These are used for high speed transmission and longer distances. Multi-mode fibres and fibre-optic connectors allow more than one mode of propagation for a specific wavelength. These cause dispersion of light and limit the effective bandwidth and distance of communication. For the Fibre Remote IPE, Nortel Networks recommends single-mode fibre-optic cables.

To connect the Electro-optical packlet from the Fibre Superloop Network and Fibre Peripheral Controller card faceplate to the optical I/O panel, two optical patchcords are used. For a redundant configuration, four optical patchcords are used, two for transmit sides and two for receive sides.

Electro-optical equipment planning form—example

Table 5 shows a sample planning form. It lists components required to construct a fibre-optic link.

Table 5
Example of the planning form for a wall-mounted Fiber Remote IPE

Item	Part Number	Quantity at Meridian 1	Quantity at Remote IPE
FXNET card		1	
FXPEC card			1
EOI packlet		1 or optionally 2	1 or optionally 2
EOI packlet blank		1 for a non-redundant link	1 for a non-redundant link
I/O panel		1	1
I/O to faceplate cords		2	2
FP/CP connectors		2	2
Fibre-optic cable (if 1 km lengths)			10 (10 km link)
Splicing			

Electro-optical equipment planning form

Enter the part number and the quantity for each item required at Meridian 1, for the fibre-optic link, and at the Fibre Remote IPE.

Table 6
Ordering form

Item	Part Number	Quantity at Meridian 1	Quantity at Remote IPE

Equipment installation and configuration

Reference list

The following are the references in this section:

- *M1250 and M2250 Attendant Consoles description (553-2201-117)*
- *Meridian 1 installation planning (553-3001-120)*
- *Meridian 1 system engineering (553-3001-151)*
- *Meridian 1 power engineering (553-3001-152)*
- *Meridian 1 system installation procedures (553-3001-210)*
- *Circuit card installation and testing (553-3001-211)*
- *Telephone and attendant console installation (553-3001-215)*

This chapter describes the installation of the Fibre Remote IPE as an integral part of the Meridian 1 system. It explains how to prepare the site and check the equipment before installing it.

System overview

Fibre Remote IPE service can be added to existing Meridian 1 system options 21E, 51, 51C, 61, 61C, 71, 81, and 81C originally installed and operating without Fibre Remote IPE, or it can be an integral part of a newly installed Meridian 1 system. In either case, the connection of the Fibre Remote IPE to the NT1P61 Fibre Superloop Network card over the fibre-optic link should begin after:

— A previously installed Meridian 1 system is upgraded to run on generic software X11 release 19 or higher. It should operate correctly.

— A newly installed system using generic software X11 release 21 or higher. It should operate correctly.

To install a new Meridian 1 system or expand an existing one, refer to *Meridian 1 system installation procedures (553-3001-210)*. It provides the information on how to install, verify, and maintain the Meridian 1 system.

Adding one or more Fibre Remote IPE sites to a Meridian 1 system is treated as a straightforward system expansion, that is, the system should be fully operational before the Fibre Remote IPE equipment is installed and connected to Meridian 1. This simplifies installation and fault isolation during installation. To complete the installation of a Fibre Remote IPE site, you should perform the preinstallation procedures to prepare the site, install the fibre-optic link, and install and connect the equipment.

Preinstallation procedures include:

— Preparing the site

— Unpacking and inspecting the equipment

— Routing and splicing fibre-optic cables to create a fibre-optic link between two sites

— Connecting the fibre-optic link FC/PC optical connector to the Fibre Remote IPE

— Taking an inventory of Fibre Remote IPE equipment

— Selecting the Meridian 1 network slot for the NT1P61 Fibre Superloop Network card

Installation procedures include:

— Installing the NT1P61 Fibre Superloop Network card in the selected network card slot

— Installing the NT1P63 Electro-optical packlets into the NT1P61 Fibre Superloop Network card

— Installing the fibre-optic patchcords between the Fibre Superloop Network faceplate FC/PC optical connectors and the optical I/O panel at the rear of the Meridian 1 module housing the NT1P61 Fibre Superloop Network card

— Connecting the fibre-optic link FC/PC optical connector to the optical I/O panel at the rear of the Meridian 1 module housing the NT1P61 Fibre Superloop Network card

— Connecting the master system monitor and TTY terminal cables at the local site

— Connecting the fibre-optic link to the I/O panel

— Installing the Fibre Remote IPE column or cabinet

— Installing the NT1P62 Fibre Peripheral Controller card in Remote IPE module or cabinet controller card slot

— Installing the NT1P63 Electro-optical packlet(s) on the NT1P62 Fibre Peripheral Controller card

— Installing the fibre-optic patchcords between the Fibre Peripheral Controller faceplate FC/PC optical connectors and the optical I/O panel at the rear of the module

— Connecting the slave system monitor and TTY terminal cables at the remote site

— Connecting the fibre-optic link to the Fibre Remote IPE

Fibre Remote IPE is offered in two versions to provide flexibility in line size and equipment location. These are:

— Floor-standing column

— Wall-mounted cabinet

Note: The floor-standing column consists of one IPE Module and houses up to 16 IPE cards. The wall-mounted cabinet may consist of only the main cabinet when 10 or fewer IPE cards are required, or the main and expansion cabinets when up to 16 IPE cards are required.

Preinstallation preparation

Preinstallation preparation consists of preparing the site, unpacking and inspecting components, taking inventory, selecting the network slot for the NT1P61 Fibre Superloop Network card, installing the card, installing the fibre-optic link, and preparing the remote site cables, grounding, power source, and the location of the Remote IPE column or cabinets.

Preparing the site

When preparing a site, you must address environmental, structural, and electrical factors. These factors must be considered for the entire system, that is, Meridian 1 and Fibre Remote IPE sites. This information is available in:

— *Meridian 1 installation planning (553-3001-120)*

— *Meridian 1 system engineering (553-3001-151)*

— *Meridian 1 power engineering (553-3001-152)*

To prepare the site for Fibre Remote IPE installation, you must first:

1 Install and verify the operation of Meridian 1 without linking Meridian 1 to the Fibre Remote IPE site(s). Refer to *Meridian 1 system installation procedures (553-3001-210)*.

2 Install the Fibre Remote IPE column. Also refer to *Meridian 1 system installation procedures (553-3001-210)*, or

Install the cabinet version of Fibre Remote IPE as described in "Installing the wall-mounted cabinet" on page 74.

3 Route and splice the fibre-optic cable between the Meridian 1 site and Fibre Remote IPE site(s) as described in "Connecting the fibre-optic link to the Remote IPE Module" on page 73.

Unpacking and inspection

Unpack and inspect the equipment for damage. When unpacking, follow general precautions recommended by computer and telephone equipment manufacturers:

— Remove items that generate static charge from the installation site.

— Use antistatic spray if the site is carpeted.

— Ground yourself before handling any equipment.

— Remove equipment carefully from its packaging.

— Visually inspect the equipment for obvious faults or damage. Any damaged component must be reported to your sales representative and the carrier who delivered the equipment.

— Do not bend and twist the fibre-optic cables excessively. Make sure that the cable is not bent beyond the specified minimum bending radius of 1.4 inches (3.5 cm) when handled or installed.

— Hold the plug-in cards by their nonconducting edges and keep them in their antistatic bags until you are ready to install them.

— Do not stack the plug-in cards on top of each other.

Taking inventory

After the equipment has been unpacked and visually inspected, verify that all the equipment is at the site before the installation begins. Equipment received must be checked against the shipping documents. Any shortages must be noted and reported to your sales representative.

Installing the fibre-optic link

If the fibre-optic link already exists, check the fibre-optic link characteristics and the end-to-end loss to determine if the link can support a Fibre Remote IPE and, if it can, at what distance between Meridian 1 and the Fibre Remote IPE.

Consult your Nortel Networks distributor to learn how to verify that the existing fibre-optic link is suitable for the Fibre Remote IPE application and what equipment to use to do so.

To install the fibre-optic link to the Fibre Remote IPE, the link fibres must be terminated with FC/PC optical connectors at the Meridian 1 site. At the Fibre Remote IPE, the link fibers are also terminated with FC/PC optical connectors for the floor-standing modular system. For the wall-mounted cabinet system, however, the link fibres are terminated into a fibre management frame and continue from the fibre management frame to the Electro-optical packlet FC/PC optical connectors on the Fibre Peripheral Controller faceplate.

When routing the cables to the Meridian 1 column, the floor-standing Fibre Remote IPE column, or wall-mounted Fibre Remote IPE cabinet, take the following precautions:

— Do not bend the fibre-optic cable or individual fibres beyond the minimum bending radius of 1.4 inches (3.5 centimeters).

— Protect the exposed parts of the cable and fibres with plastic conduit.

— Terminate each selected fibre with an FC/PC optical connector (a fibre-optic cable may contain more fibres than required by the single or redundant link design). At the fibre management frame, the type of optical connectors used depends on the available frame optical connectors.

Mark each fibre with Tx (transmitting) or Rx (receiving) designator behind the FC/PC optical connector to identify its function in the link.

WARNING

When handling optical fibers, follow the recommended safety procedures at all times.

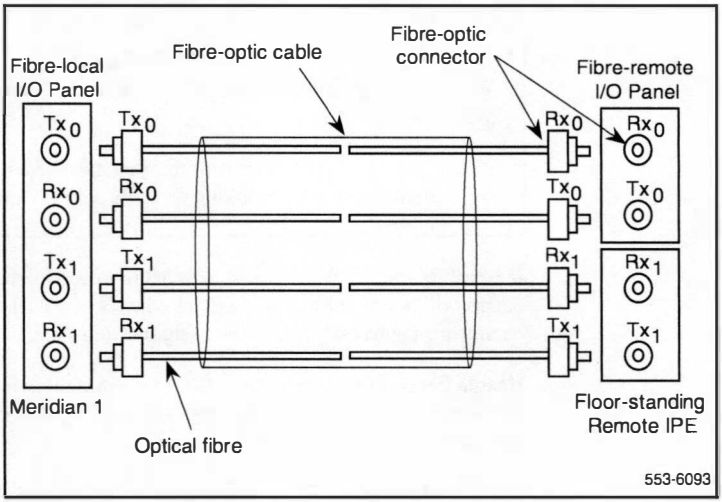
Before you can handle optical fibres, you must take necessary training and become certified in working with fibre-optic cables.

If possible, shut off power to all external transmission equipment so light beams will not be present at the exposed ends of the fiber cables. Keep all connectors capped while the cables are disconnected.

Handle fibers with extreme care. Observe a minimum bending radius of 1.4 inches (3.5 cm) at all times. Optical connections to the optical units should be finger-tightened only.

The link fibre marked Tx_0 at the remote site must be marked Rx_0 at the local site, and the link fibre marked Rx_0 at the remote site must be marked Tx_0 at the local site. For a redundant link, in addition to Tx_0 and Rx_0, Tx_1 at the remote site must be marked Rx_1 at the local site, and Rx_1 at the remote site must be marked Tx_1 at the local site as shown in Figure 8.

Figure 8
Fibre optic link



Selecting the Fibre Superloop Network card slot

The position of the NT1P61 Fibre Superloop Network card in Meridian 1 depends on the Meridian 1 system option installed at the local site. The system option determines what type of module will house the card.

Table 7 lists modules that provide network card slots, the system options where these modules are used, and card slots where network cards can be housed.

Table 7
Modules supporting a Fibre Superloop Network card

Modules	System option	Network card slot
NT5D21 Core/Network Module	51C, 61C, 81C	Card slots 0–7
NT8D11 CE/PE Module	21E	Card slots 4–9
NT8D35 Network Module	71, 81, 81C	Card slots 5–12
NT9D11 Core/Network Module	51C, 61C	Card slots 0–7
NT6D39 CPU/Network Module	51, 61	Card slots 1–8

Network card slots in modules listed in Table 7 also house other network-type cards that contend with the NT1P61 Fibre Superloop Network card for space in the module. If one or more network card slots are empty, where to install the NT1P61 Fibre Superloop Network card is determined as follows:

1 Check all network cards in the module and see if there are any NT8D04 Superloop Network cards.

2 If no NT8D04 Superloop Network cards are installed, you can use any empty network card slot to install an NT1P61 Fibre Superloop Network card.

3 If the module contains one or more NT8D04 Superloop Network cards, you must install the NT1P61 Fibre Superloop Network card at least one network card slot away from the NT8D04 Superloop Network card. Otherwise, refer to *Meridian 1 system engineering (553-3001-151)* for a detailed explanation of where to install the NT1P61 Fibre Superloop Network card when only slots adjacent to NT8D04 Superloop Network cards are available.

Note: Each network card slot supports two network loops. Although an NT8D04 Superloop Network card physically occupies only one card slot, it nevertheless occupies four network loops. That means that two network loops of an adjacent network card slot are also occupied by the NT8D04 Superloop Network card. Therefore, only a network card not requiring network loop access can be installed in the empty card slot whose network loops are being used by the NT8D04 Superloop Network card.

Meridian 1 fibre-optic equipment installation

To complete the installation of the fibre-optic interface that links Meridian 1 to the Fibre Remote IPE equipment, you must:

— Install and verify the operation of the Meridian 1 system, if it is not already installed and operating correctly

— Identify the network card slot and install the NT1P61 Fibre Superloop Network card in Meridian 1

— Install the NT1P75 fibre-optic patchcords

— Connect the fibre-optic link to the optical I/O panel

Installing and verifying Meridian 1 operation

The Fibre Remote IPE facilities can be added to an existing Meridian 1 system running on X11 release 19 or higher, by installing the appropriate electro-optical equipment in the system, installing one or more Fibre Remote IPEs at different remote sites, and linking Meridian 1 with remote sites using single or redundant fibre-optic links.

To install a new Meridian 1 system, follow the instructions in *Meridian 1 system installation procedures (553-3001-210)*. It describes how to install a complete Meridian 1 system and how to connect the power, the internal and external communication cables, and subscriber loops.

If a new Meridian 1 system is configured with Fibre Remote IPE facilities, the system will normally be assembled at the factory with cards already installed and NT1P75 fibre-optic patchcords connected between the NT1P61 Fibre Superloop Network card faceplate and the optical I/O panel at the rear of the module housing this card. All you would have to do is connect the fibre-optic link to the Meridian 1 and the Fibre Remote IPE optical I/O panels to complete the link. However, if the card is not installed, follow the steps on page 57.

Installing the Fibre Superloop Network card

The purpose of the following steps is to instruct you how and where to install the Superloop Network card(s). In a new Meridian 1 system, the cards would have been installed in a network card slot at the factory; however, you may have to install additional NT1P61 Fibre Superloop Network cards to expand the number of remote sites or replace a defective card.

NT1P63 Electro-optical packlets, which are installed on the NT1P61 Fibre Superloop Network card, are normally installed in the factory, however, you may have to install an additional NT1P63 Electro-optical packlet on the NT1P61 Fibre Superloop Network card when you want to make a single fibre-optic link into a redundant link. The packlet and the card can be installed when the system is powered up and running.

To install these cards:

1. Set the ENB/DIS switch on the Fibre Superloop Network card to DIS.
2. Pull the NT1P61 Fibre Superloop Network card's upper locking device away from the faceplate and press the lower locking device downwards. While holding the card by these locking devices, insert it into the card guides of the selected network card slot.
3. Slide the card into the module until it engages the backplane connector.
4. Carefully push the upper locking device lever towards the faceplate and the lower locking device upwards to insert the card connector into the backplane connector and lock the card in place.

5 If not already installed, install the NT1P63 Electro-optical packlet(s) onto the NT1P61 Fibre Superloop Network card by inserting the NT1P63 Electro-optical packlet, connector first, through the NT1P61 Fibre Superloop Network card faceplate opening and plugging it into the connector on the NT1P61 Fibre Superloop Network card. For consistency, install the NT1P63 Electro-optical packlet into the top connector location if only one NT1P63 Electro-optical packlet is required (for nonredundant link operation). Install the blank packlet into the bottom connector location. For a redundant link, install both NT1P63 Electro-optical packlets.

6 Install the optical I/O patch-panel, which is a part of the NT1P76AA cable assembly, in the empty connector slot of the module's I/O panel by screwing its top and the bottom screws into the slot screw holes on the I/O panel. Use one connector slot for the FC/PC optical connectors that link the NT1P61 Fibre Superloop Network card and the NT1P63 Electro-optical packlets to the fibre-optic link, as shown in Figure 9.

7 Use another empty connector slot in the I/O panel for the System Monitor/TTY ports I/O patch-panel, also part of the NT1P76AA cable assembly, as shown in Figure 10. Screw the top and the bottom screws of the cable's connector bracket into the connector slot screw holes on the I/O panel.

8 Set the ENB/DIS switch on the Fibre Superloop Network card to ENB and observe the LED on the card as it performs self-tests. The LED should blink three times and then stay ON until enabled by software. When enabled by software, the LED turns OFF permanently, if operational.

Installing fibre-optic patchcords

NT1P75 fibre-optic patchcords connect NT1P63 Electro-optical packlets to fibre-optic connectors on the I/O panel at the rear of the network module housing the NT1P61 Fibre Superloop Network card. Figure 9 illustrates NT1P63 Electro-optical packlet FC/PC fibre-optic connectors on the NT1P61 Fibre Superloop Network card and the I/O panel at the rear of the module. To install patchcords:

1 Carefully push each patchcord through the cable channel from the front of the module to the back. For a single fibre-optic link, use one patchcord that contains two fibres, one for the receive side and one for the transmit side. For a redundant link, you need two patchcords. When handling fibre-optic cables, do not bend them more than their minimum allowed bending radius of 1.4 inches (3.5 cm).

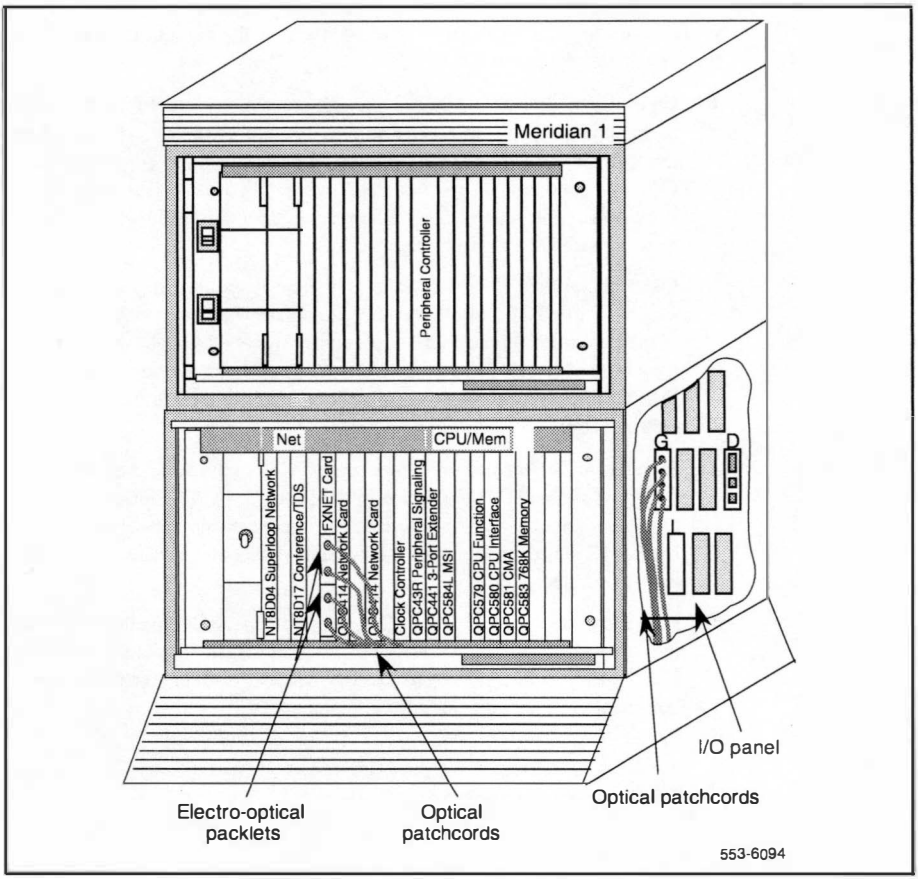
2 Install the optical I/O patch-panel in the empty connector slot of the module's I/O panel. Find an empty connector slot that matches the size of the patch-panel bracket and use two screws and two washers to install it on the I/O panel. The optical I/O patch-panel can contain up to four FC/PC fibre-optic connectors, which are used for a redundant link configuration.

3 Plug the NT1P75 fibre-optic patchcord FC/PC optical connectors into the appropriate NT1P63 Electro-optical packlet FC/PC optical connectors on the NT1P61 Fibre Superloop Network card faceplate. The receive (Rx) is the top connector on each packlet and transmit (Tx) is the bottom connector.

4 Plug the other NT1P75 fibre-optic patchcord FC/PC optical connectors into connectors at the optical I/O patch-panel at the rear of the module. Use Tx and Rx designators to identify transmit and receive patchcord connectors. Repeat this step for all patchcords.

Figure 9 shows a Meridian 1 option 51 with the NT1P61 Fibre Superloop Network card and patchcords installed.

Figure 9
Fibre Superloop Network card patchcord connections in Meridian 1



Installing system monitor and TTY cables

The system monitor cable is normally installed in the factory and does not have to be installed at the site. The cable that has to be installed at the site is the cable connecting the terminal or TTY to the RJ45 connector on the I/O panel located at the rear of the module that contains the NT1P61 Fibre Superloop Network card.

Refer to Figure 10 to see the I/O panel and the top connector. The top connector is used to connect the terminal or TTY to the Fibre Superloop Network card when the MMI port is in the MMI mode, or to connect the Fibre Superloop Network card to an SDI port when the MMI port is in the SL-1 mode.

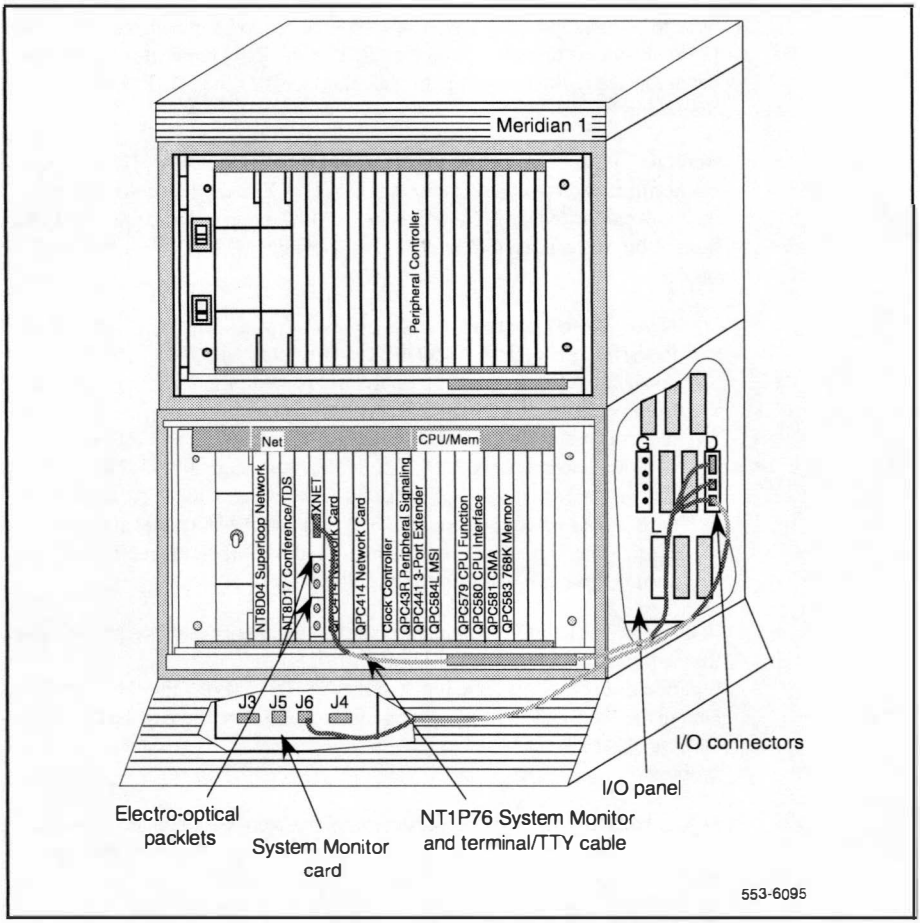
> ***Note:*** To connect the Fibre Superloop Network card to an SDI port of the SDI cards such as NTND02BA, QPC841C, or QPC139B, you must connect the RJ45 connector on the I/O panel to the RS-232 port on the front panel of the SDI card. The cable must be a null modem type with pin 2 (TD) and pin 3 (RD) swapped and provide DSR and CTS pins high (+12 V), such cable is P0695821. To connect to an NT8D41AA SDI Paddle Board to the Fibre Superloop Network card, use NT8D84 AA and NT8D93AJ cables between the SDI port and the I/O panel at the rear of the module. For switch setting on individual SDI cards, refer to *Circuit card installation and testing (553-3001-211).*

In the local Meridian 1 column, the pedestal contains a master system monitor that monitors system alarms. Alarms from a Fibre Remote IPE site are reported over the fibre-optic link and the NT1P61 Fibre Superloop Network card to the Meridian 1 master system monitor and from there to the CPU. The CPU sends alarm messages to the system terminal or TTY identifying the problem.

Figure 10 shows NT1P61 Fibre Superloop Network card connections to the I/O panel to provide an MMI, a slave system monitor, and master system monitor port.

Figure 10 also shows the connection between the system monitor card and the master monitor port on the I/O panel.

Figure 10
System monitor and TTY cable connections



To connect the NT1P61 Fibre Superloop Network card to the system monitor in the pedestal, to the slave system monitor in an adjacent column, and to the terminal or TTY:

1. Plug the 15-pin D-type connector at the one end of the NT1P76AA cable into the 15-pin D-type connector located on the faceplate of the NT1P61 Fibre Superloop Network card.
2. Route the other end of the cable through the cable channel to the I/O panel at the back of the module with the NT1P61 Fibre Superloop Network card.
3. Install the electrical I/O patch-panel into an empty I/O panel connector slot by screwing the top and bottom screws of the cable connector bracket to the connector slot on the I/O panel. The electrical I/O patch-panel (bracket) is part of the NT1P76AA cable.
4. Plug the RJ11 connector at one end of the cable into the RJ11 receptacle on the I/O panel to provide an RS422 interface to the system monitor.
5. Plug the other end of the cable RJ11 connector into J6 receptacle on the system monitor in the pedestal.
6. Connect an RJ11 cable between the second RJ11 receptacle on the I/O panel and daisy-chain the I/O patch-panel connectors to other Fibre Superloop Network cards as shown in Figure 9, if required.
7. Plug the RJ45 connector at the one end of the A0361365 terminal cable into an empty connector slot on the I/O panel.
8. Plug the other end of the A0361365 terminal cable into the RJ45/RS232 adapter, and then plug this adapter into the terminal or TTY RS232 connector. An RJ45 to DB25 adapter can be used to connect a terminal that has a DB25 type connector for its RS232 interface.

9 If the Fibre Superloop Network card is connected to an SDI card, connect the A0695821 cable to the SDI port in the module.This DB-25 male to DB-25 female cable is a null modem type with DSR and CTS pulled up to +12 V. Refer to *Circuit card installation and testing (553-3001-211)* for switch setting for the specific SDI card.

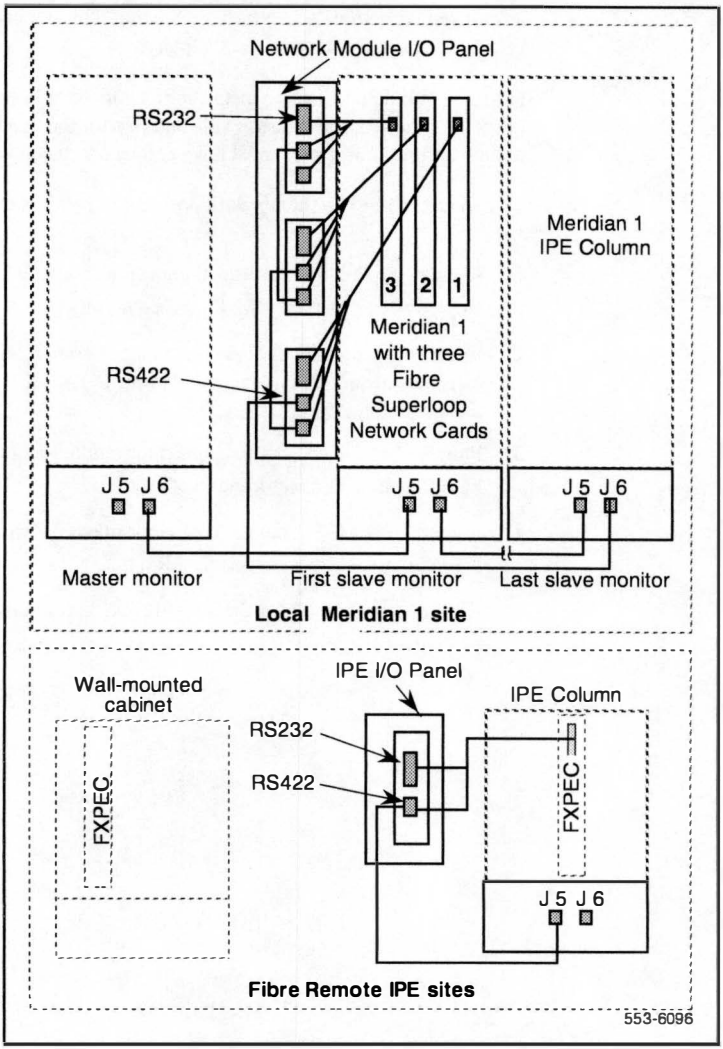
10 Plug the other end of the A0695821 cable into a DB-9 to DB-25 adapter and plug the DB-9 adapter connector into the DB-9 connector on the I/O patch-panel.

Figure 11 shows Meridian 1 columns and three NT1P61 Fibre Superloop Network cards that support three remote sites. Cable connected to the NT1P61 Fibre Superloop Network card faceplate connector provides an RS232 SDI/MMI port and two RS422 system monitor ports. Figure 11 also shows system monitor connections between multiple Fibre Superloop Network cards and the master system monitor residing in the pedestal. It shows the connection between the master and slave system monitors when multiple adjacent columns exist. At the remote site, the system monitor connects only to the module on top of the pedestal, as shown in the figure.

From Fibre Superloop Network #1, you can extend an RJ11 cable to the lowest slave system monitor J6 connector in the pedestal. This connection makes the three Fibre Superloop Network cards the lowest slave system monitors in the chain where Fibre Superloop Network card #3 is the lowest.

The Fibre Remote IPE alarms are received over the link and through the Fibre Superloop Network cards to the system monitor J6 connector.

Figure 11
System monitor connections at the Meridian 1 and the Fibre Remote IPE



Connecting the fibre-optic link to Meridian 1

Each required fibre of the fibre-optic cable, at each end of the link, must be terminated with an FC/PC optical connector. This connector plugs into the FC/PC optical connector on the I/O panel.

For a single link, you need to install connectors on only two fibres at each end of the link, one for the transmit side and one for the receive side. For a redundant link, four fibres must have connectors installed at each end.

To connect the link to the network optical I/O panel at the local Meridian 1 site:

1 Identify the link FC/PC optical connector marked Tx_0 and Rx_0 for a single link, or marked Tx_0, Rx_0, Tx_1, and Rx_1 for a redundant link.

2 Identify the transmit and receive connectors on the optical I/O panel (bracket) installed in an empty network I/O panel connector slot at the local Meridian 1 site.

3 Plug the link FC/PC optical connector marked Tx_0 into the I/O panel FC/PC optical connector marked Tx_0.

4 Plug the link FC/PC optical connector marked Rx_0 into the I/O panel FC/PC optical connector marked Rx_0.

5 Repeat steps 3 and 4 for the Tx_1 and Rx_1 if you have a redundant link.

Floor-standing column Fibre Remote IPE installation

To complete the installation of floor-standing Fibre Remote IPE equipment, you must:

— Install the floor-standing column

— Install the cards in the IPE Module

— Install the NT1P75 fibre-optic patchcords

— Connect the fibre-optic link to the optical I/O panel

Note: All Fibre Remote IPE modules or cabinets are installed in the factory with cards already in their respective card slots. The only exception is the power supply, which is packaged separately and must be installed at the site.

Installing the floor-standing column

The column is normally assembled in the factory with cards already installed and NT1P75 fibre-optic patchcords connected between the NT1P62 Fibre Peripheral Controller card faceplate and the optical I/O panel at the rear of the IPE Module.

If the column is not assembled in the factory, to install the Meridian 1 type modular column (floor-standing column) at the remote site, follow the instructions in *Meridian 1 system installation procedures (553-3001-210)*. It describes how to install the pedestal, the IPE Module, and the top cap and how to connect the power, the internal and external communication cables, and subscriber loops.

To install the PFTU to the floor-standing Fibre Remote IPE, follow the instructions in *Meridian 1 system installation procedures (553-3001-210)*.

Installing cards in the Remote IPE Module

The purpose of the following steps is to instruct you how and where to install the cards in the Remote IPE Module. Even though the cards might have been shipped installed from the factory, we provide step-by-step instructions for card installation, which should be followed when additional IPE cards are installed or defective cards are replaced.

NT1P63 Electro-optical packlets, which are installed on the NT1P62 Fibre Peripheral Controller card, are normally installed in the factory; however, you may have to install an additional NT1P63 Electro-optical packlet onto the NT1P62 Fibre Peripheral Controller card when you want to make a single fibre-optic link into a redundant link.

To install these cards:

1 Pull the NT1P62 Fibre Peripheral Controller card's upper locking device away from the faceplate and press the lower locking device downwards. Which holding the card by these locking devices, insert it into the card guides into the Controller slot left-hand card guide, which is located immediately to the right of slot 7.

2 Slide the card into the cabinet until it engages the backplane connector.

3 Push the upper locking device lever towards the faceplate and the lower locking device upwards to insert the card connector into the backplane connector and lock the card in place.

4 Observe the LED on the card as it performs self-tests. The LED should blink three times and then stay ON until enabled by software. When enabled by software, the LED turns OFF permanently, if operational.

5 Install the NT1P63 Electro-optical packlet onto the NT1P62 Fibre Peripheral Controller card by inserting the NT1P63 Electro-optical packlet, connector first, through the NT1P62 Fibre Peripheral Controller card faceplate opening and plugging it into the connector on the NT1P62 Fibre Peripheral Controller card. For consistency, install the NT1P63 Electro-optical packlet into the top connector if only one Electro-optical packlet is required (for single link operation). Install a blank packlet in place of the second NT1P63 Electro-optical packlet.

6 Install IPE cards in slots 0 through 7 and 8 through 15 by pulling the card locking devices away from the faceplate and inserting the cards into the card guides of an IPE card slot.

7 Slide the card into the module until it engages the backplane connector, and then push the locking device levers towards the faceplate to insert the card connector into the backplane connector and lock the card in place.

8 Repeat steps 6 and 7 for each IPE card.

9 Remove the back panel to access the I/O panel connector slots.

10 Install the optical I/O patch-panel in the empty connector slots of the IPE Module's I/O panel by using two screws and two washers for each connector. Use connector slots J2 and J3 for the FC/PC optical connectors that link the NT1P62 Fibre Peripheral Controller card and NT1P63 Electro-optical packlets, using patchcords, to the fibre-optic link, as shown in Figure 12. Use the empty J4 and J5 connector slots in the I/O Panel for the System Monitor and TTY I/O patch-panels, as shown in Figure 13.

Installing fibre-optic patchcords

NT1P75 fibre-optic patchcords connect NT1P63 Electro-optical packlets to FC/PC fibre-optic connectors on the I/O panel at the rear of the IPE Module. Figure 12 illustrates NT1P63 Electro-optical packlets FC/PC fibre-optic connectors and FC/PC fibre-optic connectors on the I/O panel at the rear of the module. To install the patchcords:

1 Carefully push each NT1P75 fibre-optic patchcord through the cable channel from the front of the module to the back. For a single fibre-optic link, use one patchcord that contains two fibres, one for the receive side and one for the transmit side. For a redundant link you need two patchcords. When handling fibre-optic cables, do not bend them more than their minimum allowed bending radius of 1.4 inches (3.5 cm).

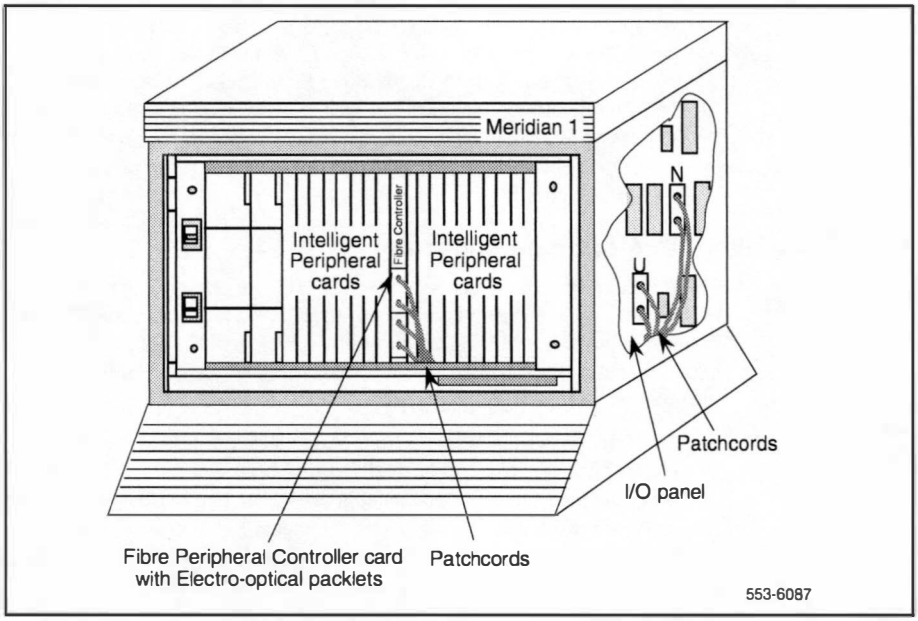
2 Plug NT1P75 fibre-optic patchcord FC/PC optical connectors into the appropriate NT1P63 Electro-optical packlet FC/PC optical connectors on the NT1P62 Fibre Peripheral Controller faceplate.

3 Plug the other NT1P75 fibre-optic patchcord FC/PC optical connectors to the FC/PC fibre-optic connectors on the I/O panel.

4 Repeat steps 2 and 3 for all patchcords.

Figure 12 shows the Fibre Remote IPE Module with IPE cards and the NT1P62 Fibre Peripheral Controller card already installed. It also shows the NT1P75 fibre-optic patchcords routing from the NT1P62 Fibre Peripheral Controller card faceplate to the module's FC/PC optical connectors on the I/O panel.

Figure 12
Patchcord connections on the IPE Module



Installing system monitor and TTY cables

The system monitor cable is normally installed in the factory and does not have to be installed at the site. The cable that has to be installed at the site is the cable connecting the terminal or TTY to the 9-pin D-type connector on the IPE Module I/O panel (the MMI port).

In the remote floor-standing column, the pedestal contains a slave system monitor used to monitor Fibre Remote IPE system alarms. These alarms are reported over the fibre-optic link and through the NT1P61 Fibre Superloop Network card to the Meridian 1 master system monitor and from there to the CPU. The CPU sends alarm messages to the system terminal or TTY identifying the problem.

These alarms are also displayed or printed on the remote site terminal or TTY. Figure 13 shows the system monitor and TTY cable connections for a floor-standing column.

To connect the NT1P62 Fibre Peripheral Controller card to the terminal or TTY and the slave system monitor in the pedestal; you must follow these steps to install NT1P78AA Y cable between the backplane and the I/O panel:

1 Plug the NT1P78AA cable 24-pin connector into the 24-pin connector (SL0 position) located at the top center of the backplane behind the NT1P62 Fibre Peripheral Controller card.

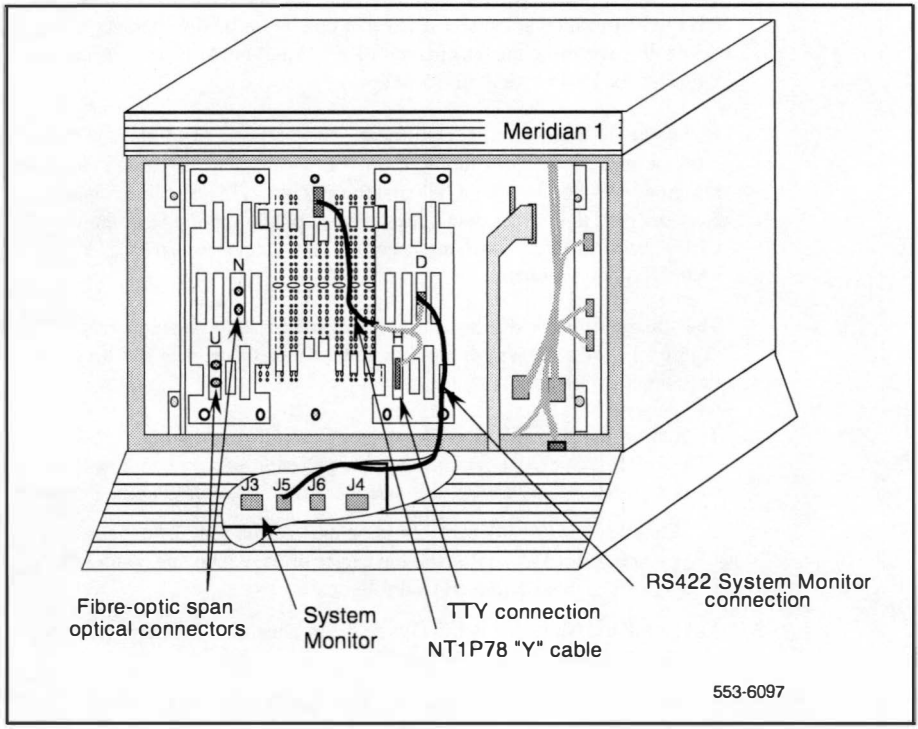
2 Install the NT1P78AA I/O D-type patch-panel into the empty connector slot of the IPE Module I/O panel.

3 Install the NT1P78AA cable RJ11 I/O patch-panel on the empty connector slot of the IPE Module I/O panel.

4 Plug the RJ11 connector at one end of the cable into the RJ11 receptacle on the IPE Module I/O panel. This cable provides an RS422 interface to the system monitor.

5 Plug the other end of the cable RJ11 connector into the J6 receptacle on the system monitor in the pedestal. Refer to Figure 11 for connecting system monitoring cables for a column with the IPE Module.

Figure 13
System monitor and TTY cable connections



6 Check the NT8D22 System Monitor factory switch settings for the slave system monitor. Refer to *Option settings, Circuit card installation and testing (553-3001-211)*.

7 Plug the NTAK1108 9-pin D-type connector into the 9-pin D-type connector on the IPE Module I/O panel.

8 Plug the other end of the NTAK1108 cable into the terminal or TTY RS232 connector.

Connecting the fibre-optic link to the Remote IPE Module

The fibre-optic link connects the optical I/O panel connector at the rear of the Remote IPE Module to the optical I/O panel at the rear of the module housing the NT1P61 Fibre Superloop Network card in the Meridian 1 system. The routing and splicing of fibre-optic cables along the link should have been completed before the Fibre Remote IPE site installation.

Each fibre of the fibre-optic cable, at each end of the link, must be terminated with an FC/PC optical connector. This connector plugs into the FC/PC optical connector on the I/O panel.

For a single link, you need to connect only two fibres at the end of the cable, one for the transmit side and one for the receive side. For a redundant link, four fibres must be connected.

To connect the link to the Remote IPE I/O panel:

1 Identify one link fibre as Tx_0 and another as Rx_0 for a single link, or identify four fibres as Tx_0, Rx_0, Tx_1, and Rx_1 respectively for a redundant link.

2 Identify the transmit and receive connectors on the optical I/O panel at the rear of the Remote IPE Module.

3 Plug the link FC/PC optical connector marked Tx_0 into the I/O panel FC/PC optical connector marked Tx_0.

4 Plug the link FC/PC optical connector marked Rx_0 into the I/O panel FC/PC optical connector marked Rx_0.

5 Repeat steps 3 and 4 for the Tx_1 and Rx_1 if you have a redundant link.

Wall-mounted Fibre Remote IPE installation

To complete the installation of wall-mounted Fibre Remote IPE equipment, you must:

— Install the wall-mounted cabinet

— Install the cards in the cabinet

— Connect the fibre-optic link to the fibre management frame and the Fibre Peripheral Controller card

Installing the wall-mounted cabinet

To install NT1P70 main and NTAK12 expansion wall-mounted cabinets that house the Fibre Remote IPE, follow the instructions below.

The NT1P70 main wall-mounted cabinet is shipped from the factory completely installed, that is, all IPE cards and the NT1P62 Fibre Peripheral Controller card are already installed. The power supply is shipped separately. The NTAK12 expansion cabinet is optional and is ordered only if you require more than 10 IPE cards at the remote site.

To install wall-mounted Remote IPE cabinets, locate and prepare the wall area, install cabinets, connect the ground wires, and connect the power. When selecting the wall area for the cabinet installation, make sure you provide for convenient fibre-optic and subscriber loop cable routing.

To complete these tasks, follow the steps below:

1 Unpack and inspect the cabinet.

2 Level and install the mounting bracket on the wall as shown in Figure 14. If you are installing the expansion cabinet next to the main cabinet, line up the two brackets and use the provided spacer between brackets.

3 Remove the front cover and all cards from the cabinet to make the cabinet lighter and to prevent card damage in case the cabinet drops when being installed on the wall.

4 Position the cabinet over the mounting bracket so that the bracket hook engages the slot at the rear of the cabinet. The slot is located at the top center of the cabinet as shown in Figure 14.

5 Bolt the cabinet down by using two wood screws at the lower front of the cabinet. See Figure 14 for the location of the screw holes.

6 Install the 6 AWG copper ground wire between the approved building ground and the ground lug at the bottom of the cabinet.

7 Repeat steps 3 through 6 for the expansion cabinet, if required.

Figure 14 shows the Fibre Remote IPE cabinet with the mounting bracket and the mounting holes. It also shows the ground lug for ground connection.

8 Install the power supply in slot 0 in the NT1P70 main cabinet shelf and turn the power switch to OFF.

9 At the building ground end of the wire, use two fastening clamps to connect the wire to the building ground, insulate the connection with electric tape, and post a DO NOT DISCONNECT tag.

10 Measure the ground resistance between the ground lug at the bottom of the NT1P70 main cabinet and the ground prong on the cabinet power cord. It should measure 0 Ohms. If the resistance is greater then 0 Ohms, check the ground terminal on the power supply power connector continuity to the cabinet chassis.

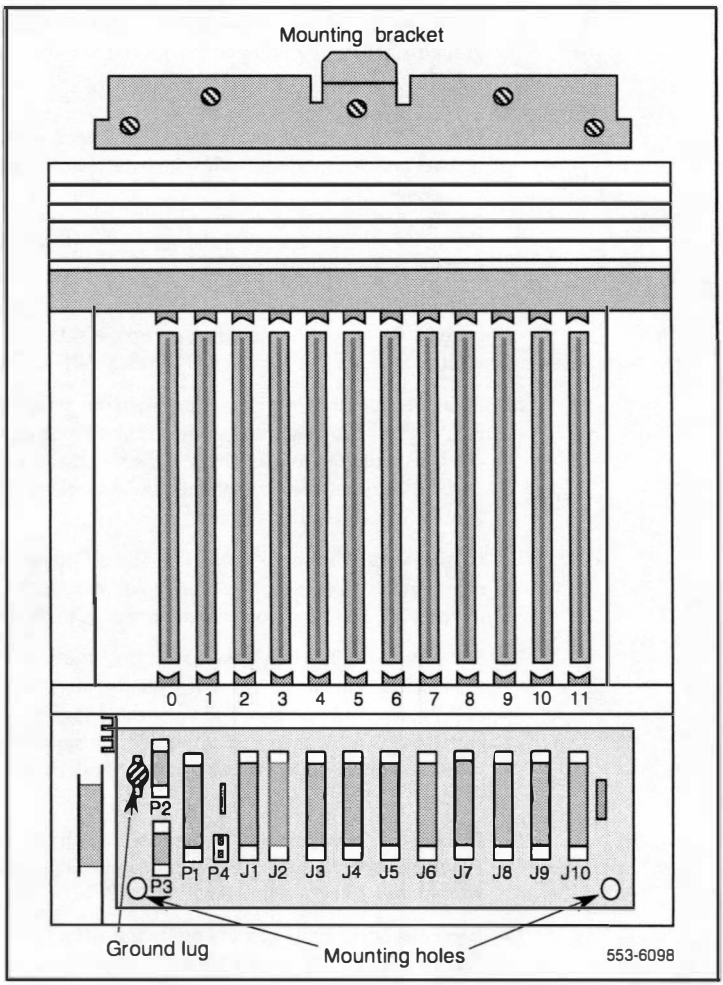
11 Connect the power cord from the IPE shelf power supply to the commercial AC power outlet for an AC system. For a DC system, connect the IPE shelf power converter cord to the DC power source.

12 Disconnect the building ground wire from the ground lug on the NT1P70 main cabinet and measure the resistance between the tip of the disconnected ground wire and the ground lug on the cabinet. If the resistance is more than 5 Ohms, check the building ground and the ground terminal at the AC wall outlet where the cabinet power cord is connected.

13 Disconnect the power cord from the wall outlet for the AC system or the DC power source for the DC system and reconnect the 6 AWG ground wire to the cabinet ground lug.

14 Reconnect the supply power cord to the AC power outlet for an AC system or to the DC source for a DC system.

Figure 14
Fibre Remote IPE cabinet



15 If the Fibre Remote IPE requires an expansion cabinet to accommodate up to 16 IPE cards, repeat steps 1 through 14 for the NTAK12 expansion cabinet.

16 Connect the NT1P70 main cabinet to the NTAK12 expansion cabinet by installing the cable between connector P1 of the main cabinet and P1 of the expansion cabinet.

This completes the cabinet installation and system ground test. You can now install the plug-in cards.

Installing cards in the wall-mounted cabinet

The purpose of the following steps is to instruct you how and where to install the cards in the Fibre Remote IPE cabinet. Even though the cards are shipped in the cabinet from the factory, for safety and ease of installation, you have removed these cards from the cabinet before you installed it onto the wall.

NT1P63 Electro-optical packlets, which are installed on the NT1P62 Fibre Peripheral Controller card, are normally installed in the factory; however, you may have to install an additional NT1P63 Electro-optical packlet on the NT1P62 Fibre Peripheral Controller card when you want to make a single fibre-optic link into a redundant link.

To install these cards:

1 Pull the NT1P62 Fibre Peripheral Controller card's locking devices away from the faceplate. While holding the card by these devices, insert the card into the card guides in slot 1. Refer to Figure 16 for card positions in the shelf.

2 Slide the card into the cabinet until it engages the backplane connector, and then push the locking device levers towards the faceplate to insert the card connector into the backplane connector and lock the card in place.

3 If not already installed, install the NT1P63 Electro-optical packlet on the NT1P62 Fibre Peripheral Controller card by inserting the NT1P63 Electro-optical packlet, connector first, through the NT1P62 Fibre Peripheral Controller card faceplate opening and plugging it into the connector on the NT1P62 Fibre Peripheral Controller card. If only one NT1P63 Electro-optical packlet is required (for single link operation), for consistency, insert the NT1P63 Electro-optical packlet into the top connector and install the blank packlet into the bottom connector.

4 Install IPE cards in slots 2 through 11 by pulling the card locking devices away from the faceplate and inserting the cards into the card guides, engaging the backplane connector, and locking the card in place by pressing the locking devices against the card faceplate.

Connecting fibre-optic link to the wall-mounted cabinet

In the wall-mounted cabinet configuration, the fibre-optic link connects to the fibre management frame located within 100 feet of the cabinet. From the fibre management frame, the optical cable is routed to the cabinet and connected directly to the NT1P63 Electro-optical packlet FC/PC optical connectors located on the NT1P62 Fibre Peripheral Controller card faceplate. Figure 15 shows a fibre-optic link connected to the NT1P63 Electro-optical packlets.

> ***Note:*** For detailed information on how to interconnect the fibre-optic link and the Fibre Remote IPE wall-mounted cabinet at the fibre management frame, refer to the *Interconnect Configuration Installation and maintenance* (A0392186) documentation package.

To connect the link:

1 Install optical connectors on the link fibres and connect the link to the fibre management frame optical connectors.

2 Install the optical connectors at the end of each fibre of the NT1P79 optical cable, and insert each connector into the fibre management frame connector where the corresponding link fibre is connected. Repeat this for each NT1P79 optical cable coming from the wall-mounted Fibre Remote IPE cabinet.

3 At the Remote IPE cabinet, carefully push the cable end(s) through the protective tubing to guide, support, and protect the cable under the cabinet, as shown in Figure 15.

Note: When handling fibre-optic cables, do not bend them more than their minimum allowed bending radius of 1.4 inches (3.5 cm).

4 Wrap each cable around a plastic drum located at the bottom left-hand side of the cabinet as viewed from the front. Extend it through the hole at the bottom of the cabinet as shown in Figure 15. For a redundant link, repeat this step for the second cable.

5 At the wall-mounted cabinet, plug the fibre-optic cable with FC/PC optical connectors at one end (as supplied with the cabinet) into the Fibre Peripheral Controller card Electro-optical packlet(s) in the cabinet.

- Identify the transmit and receive FC/PC optical connectors on the cable and the transmit and receive FC/PC optical connectors on the NT1P62 Fibre Peripheral Controller faceplate.
- Plug the cable FC/PC optical connector marked Tx_0 into the lower FC/PC fibre-optic connector on the Electro-optical packlet marked Tx_0 located on the Fibre Peripheral Controller faceplate.
- Plug the link's FC/PC optical connector marked Rx_0 into the upper FC/PC fibre-optic connector on the Electro-optical packlet marked Rx_0 located on the Fibre Peripheral Controller faceplate.
- Repeat the previous two steps for the link's FC/PC optical connectors Tx_1 and Rx_1, for a redundant link.

Figure 15 shows the tube that protects the fibre-optic link cable from damage. It also shows the routing of the fibre-optic link to the FC/PC optical connectors on the NT1P63 Electro-optical packlets installed in the NT1P62 Fibre Peripheral Controller card.

Figure 15
Optical cable routing for the wall-mounted cabinet

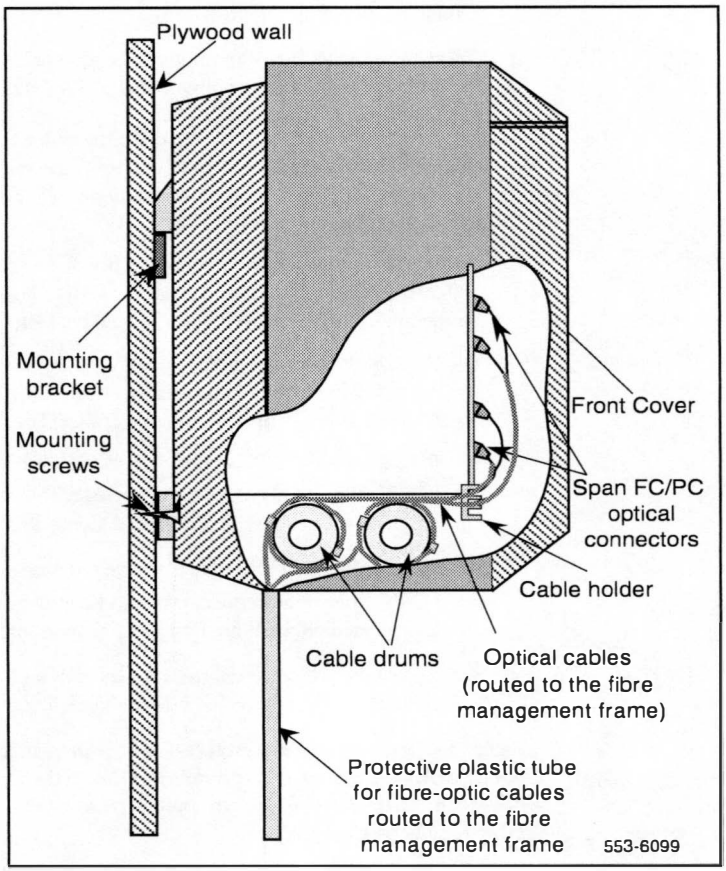
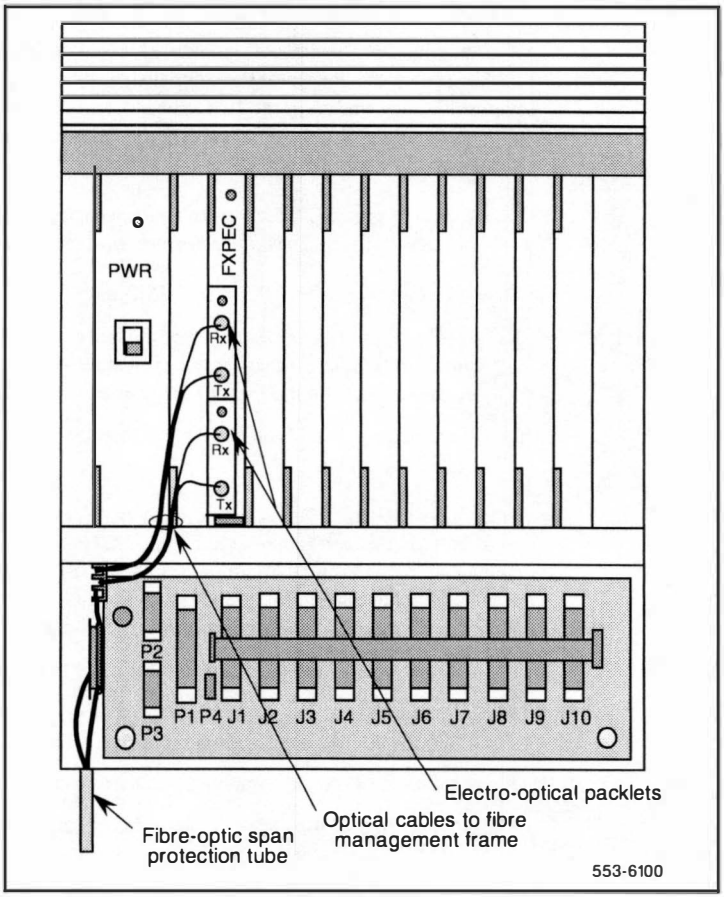


Figure 16 shows the Fibre Remote IPE cabinet with IPE cards, the NT1P62 Fibre Peripheral Controller card, and link connectors already installed.

Figure 16
Link connections on the IPE cabinet



Connecting TTY and subscriber loop cables

In the cabinet option, the monitoring is performed by the NT1P62 Fibre Peripheral Controller card, which receives power fail signals from the power supply through the backplane and sends the information to the NT1P61 Fibre Superloop Network card for processing by the Meridian 1 CPU.

A terminal or a TTY connection to the MMI port and subscriber loop connections at the bottom of the cabinet should be made as shown in Figure 17. The terminal or the TTY is used for configuration and maintenance of the remote site. The terminal or TTY transmission characteristics are 9600 bps, 8 bits, no parity.

> *Note:* To set the TTY interface characteristics on an SDI card, refer to switch settings in *Circuit card installation and testing (553-3001-211).*

To connect a terminal or TTY to the MMI port:

1 Plug the 9-pin D-type connector at the one end of the NT8D46AG cable into the P2 connector located at the lower left-hand side of the backplane, when viewed from the front or the cabinet.

2 Plug the other end of the NT8D46AG cable into the terminal or TTY RS232 connector.

To connect subscriber loop (tip and ring) cables to the cabinet's 50-pin connectors J1 through J10, refer to Figure 17. These cables have already been connected to the Main Distribution Frame (MDF) in the preinstallation preparation phase according to the instructions in *Cabling lines and trunks, Meridian 1 system installation procedures (553-3001-210)*:

1 Remove the locking bar from connectors J1 through J10.

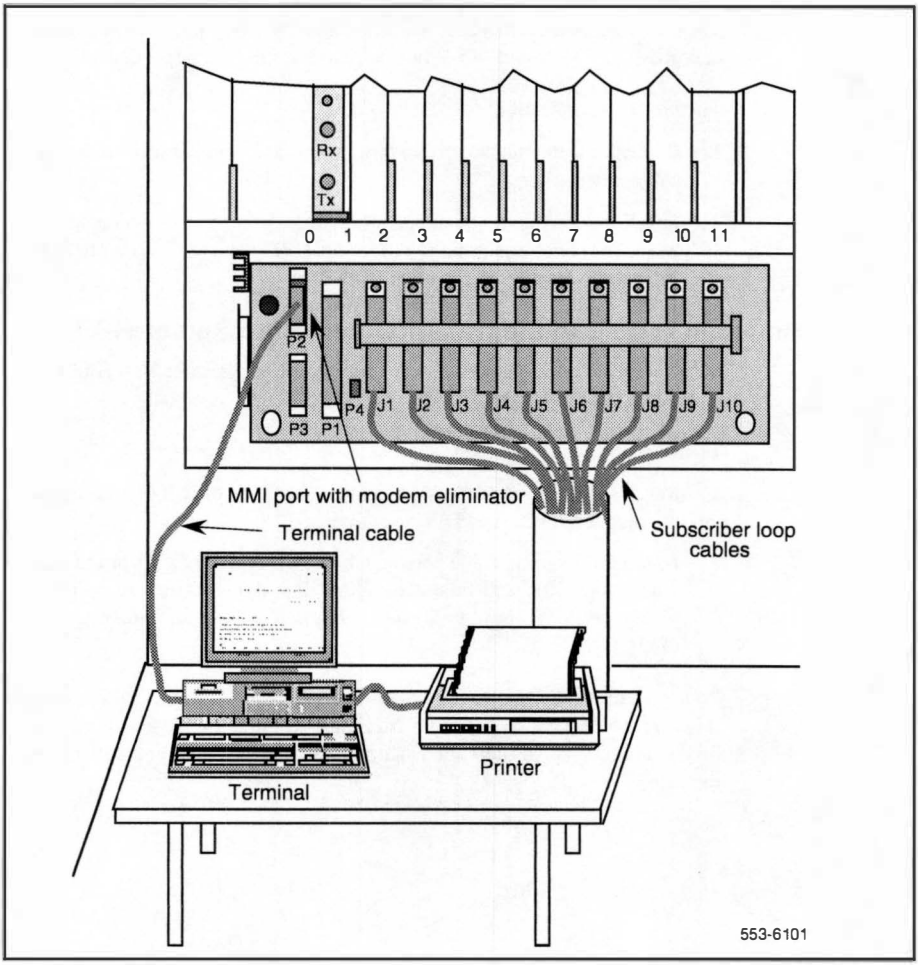
2 Install the 50-pin connector terminating the cable designated J1 and plug it into the connector at the bottom of the cabinet also designated J1.

3 Repeat step 2 for the remaining tip and ring cables from J2 through J10.

4 Replace the locking bar over the cable connectors you just installed.

Figure 17 shows the subscriber loop (tip and ring) connectors that link line cards to the MDF and the terminal connection.

Figure 17
TTY and subscriber loop cable connections



Connecting attendant console power cord to the wall-mounted Fibre Remote IPE

The wall-mounted cabinet backplane contains P4, a two-pin power connector that provides +15 V and –15 V power source for the attendant console.

To make this connection:

1 Connect the attendant console power cord to P4 on the wall-mounted cabinet backplane.

2 Install and configure the attendant console. Refer to *Telephone and attendant console installation (553-3001-215)* and *M1250 and M2250 Attendant Consoles description (553-2201-117).*

Connecting PFTU to the wall-mounted Fibre Remote IPE

In the wall-mounted cabinet option, the Power Fail Transfer Unit (PFTU) is connected as shown in Figure 18.

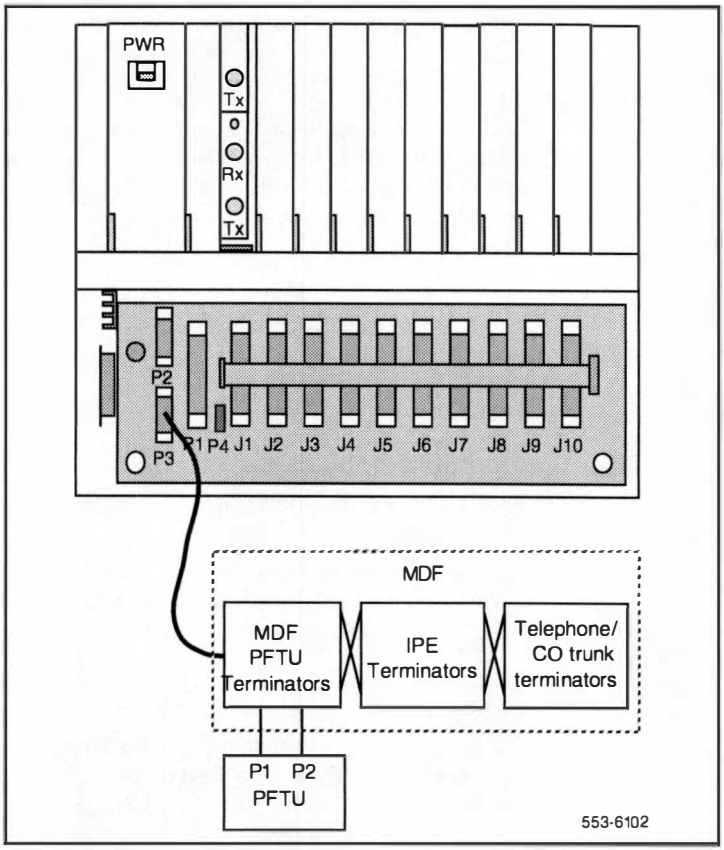
To make this connection:

1 Install the PFTU near the MDF and connect it to the MDF according to the instructions in the PFTU user manual.

2 Install the required cable between the PFTU and the P3 15-pin D-type connector on the wall-mounted cabinet. For more information on how to install the PFTU, refer to *Meridian 1 system installation procedures (553-3001-210).*

Figure 18 illustrates the front view of the wall-mounted Remote IPE cabinet. It shows the connection of the P3 Auxiliary 15-pin D-type connector on the Fibre Remote IPE wall-mounted cabinet linking the cabinet to the PFTU and the MDF.

Figure 18
Connecting PFTU to the wall-mounted Remote IPE cabinet



Configuring the Fibre Remote IPE

The configuration and administration of the Fibre Remote IPE and the corresponding fibre-optic equipment at the Meridian 1 local site is identical to the standard Meridian 1 configuration and administration and does not require special considerations.

However, some initial setup functions must be considered at the remote site to identify the remote site system monitor functions of the wall-mounted cabinet to the Meridian 1 CPU. These functions are administered over a Man-Machine Interface (MMI) port connected to a terminal or a TTY at the remote site. These are:

— Configuring fibre-optic cards

— Configuring the system monitor address

— Defining the loadware

— Configuring the MMI port

Configuring fibre-optic cards

When the Fibre Remote IPE equipment is first installed, you must specify the following functions:

— Define the NT1P61 Fibre Superloop Network and NT1P62 Fibre Peripheral Controller cards as standard NT8D04 Superloop Network and NT8D01 Peripheral Controller cards.

— Load Configuration Record Program LD 97 to configure the Fibre Remote and superloop parameter data blocks.

Prompt	Response	Comment
Fibre Remote Parameters Data Block		
REQ	CHG	Change the Fibre Remote parameters
TYPE	FIRP	Fibre Remote parameters
SUPL	0-156	Superloop number associated with the Remote IPE shelf
NNDC	5-(7)-8	No-New-Data-Calls condition threshold
XSMN	(0)–63	System monitor address on the Remote IPE shelf
Superloop Parameters Data Block		
REQ	CHG	Change superloop data block

TYPE	SUPL	Superloop type
SUPL	0-156	Superloop number in multiples of 4
ST21	(NO) YES	System type 21
SLOT	(L) R	Network slot default (left) or right
SUPT	FIBR	Superloop type (Fibre)
XPE0	x 0 3	x= Fibre Peripheral Controller card, 0= starting segment, 3= ending segment
XPE1	<cr>	Fibre Peripheral Controller card 1. Usually not equipped in Fibre Remote IPE.
XPEC	1-95	Fibre Peripheral Controller card number. The superloop block is built with default parameters.

Configuring the system monitor address

Configure the system monitor address and Fibre Peripheral Controller card parameters:

— Set switches on the system monitor card to specify a unique number from 1 to 63 and the slave mode for the floor-standing Fibre Remote IPE.

— Define the system monitor address using the MMI port to identify the system monitoring functions for a wall-mounted Fibre Remote IPE cabinet, which does not contain an actual system monitor card. Specify a unique number from 1 to 63 for this system monitoring function.

— Enter time-and-date using the terminal or TTY connected to the MMI port of the Fibre Peripheral Controller or NT1P61 Fibre Superloop Network card.

Defining the loadware

Define the loadware version being downloaded using the terminal or TTY connected to the MMI port as follows:

— Load Print Program LD 22 on the system TTY and print the PSDL directory by executing

Prompt	Response	Comment
REQ	PRT	Request printing of peripheral software versions
TYPE	.PSWV	Peripheral software versions downloaded to the Fibre Superloop Network and Fibre Peripheral Controller cards

— Through the MMI port, enter the QVER command to check the firmware and loadware version on the Fibre Superloop Network card and the Fibre Peripheral Controller card.

— Compare the loadware version obtained by printing the PSDL directory using Print Program LD 22 with the version obtained using the QVER command over the MMI terminal. The two versions must be identical. If not identical, use the SVER command at the MMI terminal to set the PSDL number of the card equal to the number obtained by Print Program LD 22.

— Parameters configured with default values, such as MMI default mode, should not be changed unless default values are not acceptable.

Command	Comment
HELP	Displays a list of commands
<ESC>L	Changes the Fibre Superloop Network or Fibre Peripheral Controller card to MMI mode.
<ESC>R	Changes the Fibre Superloop Network or Fibre Peripheral Controller card to SL-1 mode.
SDEF L/R	Sets default mode to **L**ocal or **R**emote.
QDEF	Queries the MMI port default mode. Response can be **Local** or **Remote.**

STAD <d/m/y/h/m/s>	Sets the time-and-date.
SXSM n	Wall-mounted Fibre Remote IPE cabinet does not have a system monitor card. n specifies a slave system monitor number (1--63), which is identified by the Meridian 1 CPU as a slave system monitor.

Configuring the MMI port

The MMI port may be configured in the local (or MMI) mode or the remote (or SL-1 mode).

MMI (local) mode

In the MMI mode, a terminal or TTY is connected to the local MMI port at the Fibre Superloop Network card and another terminal or TTY is connected to the local MMI port at the Fibre Peripheral Controller card. Each terminal is controlling the local MMI functions of the card it is connected to.

MMI commands can be issued at each terminal to control local functions or a submit (SUBM) command and a string can be issued from a terminal or TTY to control the functions of the card at the opposite end of the fibre-optic link.

Note: When entering MMI commands, use solid caps.

The default MMI interface characteristics are set in the Fibre Peripheral Controller card EEPROM as follows:

— Speed—1200 bps

— Character width—8 bits

— Parity bit—none

— 1 stop bit

Note 1: If an SDI port is to be connected to this for remote TTY access, then this port should be configured also for the above settings.

Note 2: A null modem may or may not be required depending on SDI port setup for DTE or DCE.

SL-1 (remote) mode

In the SL-1 mode, a terminal or TTY is connected to the MMI port at the Fibre Peripheral Controller card. This terminal or TTY becomes the Meridian 1 TTY. At the Fibre Superloop Network card, the MMI port is connected to an SDI port and not to a terminal or a TTY.

For the MMI port at the Fibre Peripheral Controller card to be able to communicate with the SDI port connected to the Fibre Superloop Network card MMI port, the interface characteristics must be as follows:

— Speed—9600 bps

— Character width—7 bits

— Parity bit—space

Note: A null modem connector is required in the terminal cable.

Using Fibre Peripheral Controller card MMI terminal, place the Fibre Superloop Network card in the remote mode by executing **>SUBM R <cr>** and place the Fibre Peripheral Controller card in the remote mode by executing **>(esc) R <cr>**.

Therefore, no interface configuration steps are required whether the MMI port at the Fibre Remote IPE is configured in the MMI mode or the SL-I mode.

Fibre Remote IPE acceptance testing

Reference list

The following are the references in this section:

- *X11 input/output guide (553-3001-311)*

This section describes the acceptance testing of the Meridian 1 Fibre Remote IPE. The purpose of acceptance testing is to verify that the functions and features of the Fibre Remote IPE are operating correctly.

Overview

Acceptance testing is conducted after the system has been installed, powered up, and appears to be functioning correctly, that is, all LEDs, displays, and system messages indicate that the system is operating correctly. The Fibre Remote IPE acceptance testing should be conducted after:

— A previously installed Meridian 1 system is upgraded with Fibre Remote IPE equipment and generic software X11 release 19 or higher and operates correctly without Fibre Remote IPE equipment

— A newly installed system with Fibre Remote IPE equipment using generic software X11 release 19 higher appears to operate correctly

Acceptance testing verifies the operation of Meridian 1 functions and features at the remote site equipped with the Fibre Remote IPE.

Acceptance testing consists of:

— Checking the system

— Preparing the system for testing

— Testing Meridian 1 functions at the Fibre Remote IPE site

Checking the system

After Fibre Remote IPE equipment has been installed and configured, you can visually inspect Fibre Remote IPE cards to make sure that they are operating correctly by observing their LEDs:

— On the Fibre Superloop Network card, check the card LED located at the top of the faceplate. If the LED on the Fibre Superloop Network card is off, and the Electro-optical packlet(s) LED is also off, the card and packlets are enabled and operating correctly. If the card LED is off and the Electro-optical packlet(s) LED is on, the card is enabled and operating but the packlet is faulty. If the card LED is on, the card is disabled or faulty. To enable the Fibre Superloop Network card or to correct a problem, go to "Fibre Remote IPE fault isolation and correction" on page 120 in the Maintenance section of this manual.

— On the Fibre Peripheral Controller card, check the card LED located at the top of the faceplate. If the LED on the Fibre Peripheral Controller card is off, and the Electro-optical packlet(s) LED is also off, the card and packlets are enabled and operating correctly. If the card LED is off and the Electro-optical packlet(s) LED is on, the card is enabled and operating but the packlet is faulty. If the card LED is on, the card is disabled or faulty. To enable the Fibre Peripheral Controller card or to correct a problem, go to "Fibre Remote IPE fault isolation and correction" on page 120 in the Maintenance section of this manual.

— Check the hexadecimal display on the Fibre Peripheral Controller card. Refer to Appendix A to identify hexadecimal codes displayed by the Fibre Peripheral Controller card during self-test.

If the display and all indicator LEDs on Fibre Remote IPE equipment indicate good operating conditions, the equipment is functional and you may proceed with setting up the necessary equipment for this test.

Setting up test conditions

To conduct acceptance testing, you must have a setup that can verify basic Meridian 1 functions and features initiated and terminated at the Fibre Remote IPE site. You may be able to use the system as configured at the site according to the customer requirements and not have to modify the configuration to perform the acceptance testing.

To conduct the acceptance testing, make sure that the Fibre Remote IPE at the remote site contains at least one IPE (line) card with at least two telephones connected to its subscriber loops. If possible, use some 2500 telephones to check the ringing generator and some digital telephones to check the dual tone multifrequency (DTMF) operation. Also, make sure that a terminal or a TTY is connected to the MMI port through the Fibre Peripheral Controller card backplane connector.

If you have a wall-mounted main and extension cabinets, install at least one line card in each cabinet and connect at least one telephone to each line card subscriber loop.

Performing acceptance testing

Since functions and features at the Fibre Remote IPE site are identical to functions and features at the local Meridian I site, the main purpose of acceptance testing is to verify that fibre-optic equipment is functioning correctly. This can be accomplished by:

— performing basic voice calls

— using the MMI terminal to configure and maintain Fibre Remote IPE equipment

— checking the protection switching of the fibre-optic link

Voice calls

A voice call can be established between two voice terminals across a network, between two terminals on the same PBX, and even between two terminals on the same line card.

Acceptance testing of Fibre Remote IPE voice calls is conducted when testing the following basic system features supported by telephone sets connected to subscriber loops at the remote site:

— placing a call to the remote site

— placing a call in call hold/call retrieve

Placing a call to the remote site

From the local Meridian 1 site, place a call to a Fibre Remote IPE site by dialing a remote station directory number (extension number).

> ***Note:*** Meridian 1 treats Fibre Remote IPE subscriber loops as local loops; thus, you need to dial only the extension number to access that station.

To perform a call test:

1. From a terminal at the local Meridian 1 site, dial a terminal at the Fibre Remote IPE site and establish an active call connection.
2. Verify voice transmission by talking with the person at the other terminal. Make sure the speech is clear in both directions.
3. Maintain the connection and ask the person at the remote site to test basic calling features such as call hold/call retrieve.
4. Terminate the call.

Call hold/call retrieve

Call hold is used to place an active call on hold in order to answer an incoming call or place an outgoing call. After releasing an incoming or an outgoing call, you can retrieve the call on hold. For the wall-mounted main and expansion cabinets, you establish calls from stations connected to the subscriber loops in the main and expansion cabinets to verify the inter-cabinet cable connection.

To perform a call hold/call retrieve test:

1 From a terminal at the local Meridian 1 site, dial a terminal at the Fibre Remote IPE site and establish an active call connection.

2 Verify voice transmission by talking with the person at the other terminal.

3 Press the Hold key at the remote site to place the active call on hold.

Note: To find out how to use the feature keys on different terminals, consult the user manual supplied with the terminal.

4 Now, place an outgoing call from the terminal at the remote site by dialing an idle terminal located at the local Meridian 1 site.

5 Complete this outgoing call by first checking the voice clarity in both directions, and hang up.

6 Have another terminal call you while the first call is still on hold.

7 Answer the incoming call and place it on hold.

8 Retrieve the call first held.

9 Complete the call and hang up.

10 Retrieve the second call on hold.

11 Complete the call and hang up.

You may repeat this test for terminals connected to different subscriber loops on the same card or for different subscriber loops on different line cards in the Fibre Remote IPE module or cabinet. By making these calls, you generate traffic, which will be shown in the traffic report.

Checking the MMI terminal operation

Connect an MMI terminal to the Fibre Superloop Network card at the local site and another MMI terminal at the Fibre Remote IPE site.

1 Set the current mode of the MMI terminal to MMI mode by executing the **<esc>L** command on the MMI terminal at the local Meridian 1 site. Enter MMI commands in solid caps.

2 Check the status of the Fibre Superloop Network card by executing the **STAT** command.

3 Check the status of the Fibre Peripheral Controller card by executing the **SUMB STAT** command. This command is sent over the fibre-optic link to the Fibre Peripheral Controller card for execution.

4 Check the response to the STAT command for the local and remote sites.

5 Check the log file content by executing the **PLOG 5** to print five log messages from the file starting with the oldest message. Examine the messages.

Additional exercise of the MMI terminal will be conducted when testing the link protection switching.

Checking link protection switching

To verify that the link protection switching is operating correctly, conduct the following tests with the link:

— manual switch-over

— forced switch-over

Note: These tests can be conducted only with a redundant link configuration.

Manual switch-over

This is a unidirectional switch-over. To conduct this test:

1 Check the status of the fibre-optic link by executing the **QFIB** command from the MMI terminal. Make sure that both the PRIM and the SEC links are functional without an alarm condition.

2 Establish a call from the Fibre Remote IPE to the local Meridian 1 site. Refer to "Voice calls" on page 94 to establish the call.

3 Assuming that the traffic is carried by the primary link, perform the following step.

4 Switch the link to the secondary packlet by executing the **MANS SEC** command from the MMI terminal.

5 Verify that the call is still established over the secondary link.

6 Unplug the Tx_1 FC/PC optical connector from the secondary packlet at the local or remote site. The transmit path should automatically switch to the primary packlet.

7 The call should continue to be established.

8 Reconnect the Tx_1 FC/PC optical connector.

Forced switch-over

Forced switch-over is used when replacing an Electro-optical packlet. To conduct this test:

1 Check the status of the fibre-optic link by executing the **QFIB** command from the MMI terminal. Make sure that both the PRIM and the SEC links are functional without an alarm condition.

2 Establish a call from the Fibre Remote IPE to the local Meridian 1 site. Refer to "Voice calls" on page 94 to establish the call.

3 Assuming that the traffic is carried by the primary link, perform the following step.

4 Switch the link to the secondary packlets by executing the **FORC SEC** command from the MMI terminal.

5 Verify that the call is still established over the secondary link.

6 Clear forced switch-over by executing the **MCLR** command from the MMI terminal to enable automatic switch-over capability.

Removing the test setup

After acceptance testing has been completed and the results show that the system is operating correctly, you should remove the setup you used to conduct the testing and restore equipment according to the customer configuration.

If you used the actual customer configuration to perform these tests, you do not have to change or remove the setup.

Generating traffic reports

Use system traffic report to identify calls made during acceptance testing from the Fibre Remote IPE site and to the Fibre Remote IPE site.

To verify traffic generated during acceptance testing, use the following command to print the report:

TOPS r r

The parameters for this command are:

r r are report options. This must be one or more of the following numbers:

1 = Network traffic report

2 = Service loops traffic report

5 = Selected terminals traffic report

For more information on traffic reports, refer to the Traffic control program LD 02 in *X11 input/output guide (553-3001-311)*.

Fibre Remote IPE maintenance

Reference list

The following are the references in this section:

- *X11 features and services (553-3001-306)*
- *X11 input/output guide (553-3001-311)*
- *Meridian 1 general maintenance information (553-3001-500)*
- *Meridian 1 fault clearing (553-3001-510)*
- *Meridian 1 hardware replacement (553-3001-520)*

This section describes Meridian 1 maintenance tools and procedures for identifying Fibre Remote IPE faults, locating defective equipment, correcting problems by fixing or replacing defective equipment, and verifying the operation of Fibre Remote IPE after corrections or replacements have been made.

System overview

Fibre Remote IPE maintenance deals with two types of problems:

— Installation

— Operation

Installation problems are created during the installation of an entire Meridian 1 with the Fibre Remote IPE or during the addition of the Fibre Remote IPE to an existing system.

Operation problems occur when components fail or equipment is accidentally disconnected during normal system operation.

In either case, identifying the problem should be approached systematically. A problem may have more than one cause. To isolate the cause, a knowledge of Meridian 1 Fibre Remote IPE operation is required. This information can be found in "Fibre Remote IPE product description" on page 11. Once the cause is identified, the problem can be corrected by replacing the defective card, connecting accidentally disconnected cables, or correcting the software problem.

Meridian 1 provides built-in self-diagnostic indicators and software and hardware tools. These diagnostic facilities simplify system troubleshooting and reduce mean-time-to-repair (MTTR).

This document focuses on the maintenance of Fibre Remote IPE equipment at the remote site and in the Meridian 1 system. It requires that Meridian 1 non-Fibre Remote IPE functions operate correctly before you start diagnosing Fibre Remote IPE problems. System installation and maintenance guide sections of *Meridian 1 general maintenance information (553-3001-500)*, *Meridian 1 fault clearing (553-3001-510)*, and *Meridian 1 hardware replacement (553-3001-520)* describe how to maintain the entire Meridian 1 system. This chapter describes how to maintain the Fibre Remote IPE equipment as an integral part of Meridian 1.

Diagnostic tools

Diagnostic tools are used to troubleshoot problems in Meridian 1 including problems with the Fibre Remote IPE. When diagnosing Fibre Remote IPE problems, you may have to use more than one of these tools.

Hardware diagnostic tools

Meridian 1 hardware diagnostic tools consist of:

— card self-tests

— LED indicators

— display codes

— enable/disable switches

Self-test

A self-test is automatically performed by each Fibre Remote IPE card when you insert it in an operating system module, when you enable the card, or when you power up or reset the system. You can also perform a self-test on a card using software commands.

This test checks general card functions and determines if they are operating correctly. It is very useful when you first install the cards; on insertion, the card automatically starts self-test and it gives you an immediate indication of its operating status.

LED indicators

Meridian 1 cards are equipped with red LED indicators, and module power supplies are equipped with green LED indicators. These indicators show the status of each card or power supply.

Figure 19 shows the NT1P61 Fibre Superloop Network card. It also shows the LED that indicates the status of the Fibre Superloop Network card and one LED on each Electro-optical packlet that indicates the status of the link.

Display codes

Some Meridian I cards, such as the NT1 P62 Fibre Peripheral Controller card, are equipped with an alphanumeric display on the faceplate. Figure 20 shows two seven-segment displays on the faceplate of the Fibre Peripheral Controller card. They are used to automatically display the card status and identify possible faults with the card. These codes are displayed in hexadecimal notation and are listed and interpreted in Appendix A of this manual and in section (HEX) in *X11 input/output guide (553-3001-311).*

Codes displayed on the common equipment cards are logged into a history file and can be printed and reviewed to analyze the sequence of events leading to the presently displayed status. The last 16 codes displayed by the Fibre Peripheral Controller card are stored in memory and can be reviewed and then cleared by using Network and Signaling Diagnostic Program LD 30.

Figure 20 shows the NT1P62 Fibre Peripheral Controller card with two hexadecimal displays that display the status of the card. It shows the card LED that also indicates the state of the Fibre Peripheral Controller card and one LED on each Electro-optical packlet that shows the status of the link.

Figure 19
Fibre Superloop Network card

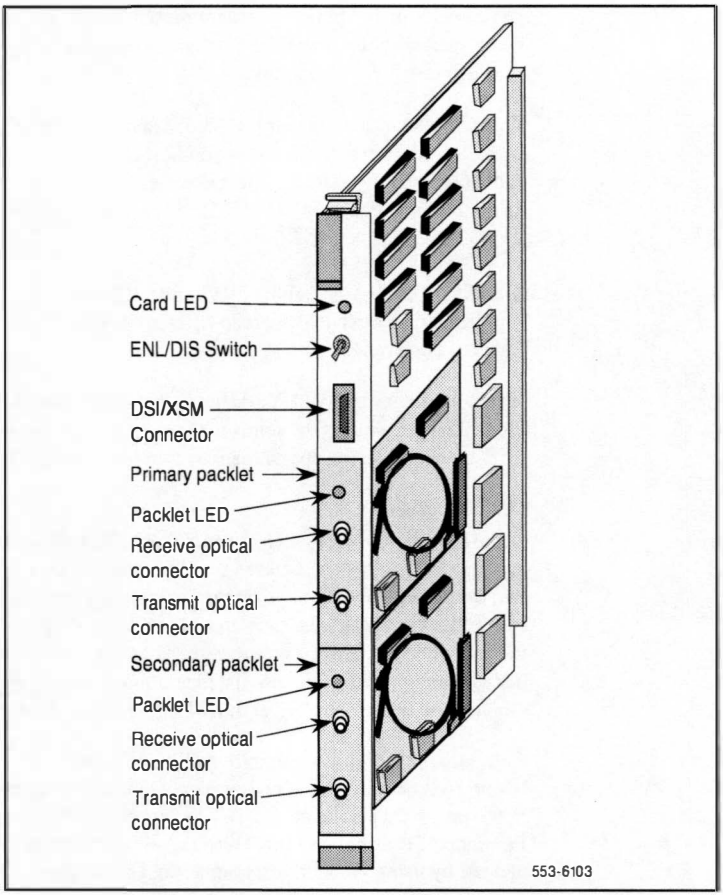
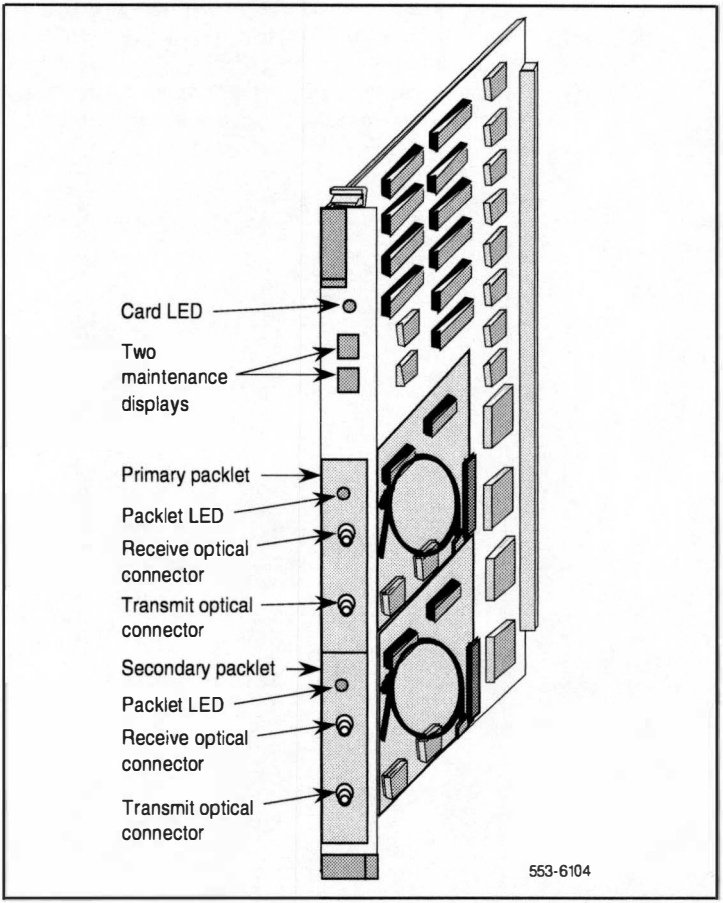


Figure 20
Fibre Peripheral Controller card



Enable/disable switch

Some Meridian 1 cards, such as the Fibre Superloop Network card shown in Figure 19, are equipped with an ENL/DIS switch. This ENL/DIS switch is located on the card's faceplate. It is used to disable the card before you remove it from an operating Meridian 1 system without disrupting other system functions. After you repair or replace the card, you can place it back in service by setting the switch to the enable position.

System monitors and alarms

Meridian 1 system monitoring units continuously monitor the environmental and power status of the system and the individual system modules including the Fibre Remote IPE equipment.

The system monitor issues alarms when:

— CPU fails or system reloads

— main power source is lost

— power supply in the modules fails

— system temperature exceeds limits because of blower or fan failure

Meridian 1 alarms are based on the type and severity of faults reported by the system monitors and indicators. These alarms are divided into:

— major alarms, which indicate serious problems that require your immediate attention

— minor alarms, which indicate isolated faults relative to a limited number of call connection problems that do not require your immediate attention

Fibre Remote IPE issues a red alarm when a major alarm occurs at the local Meridian 1 site and a yellow alarm when a major alarm occurs at the Fibre Remote IPE site.

Software diagnostic tools

Meridian 1 software diagnostic tools are used to monitor the system status, provide the ability to test various system functions and equipment suspected of being faulty, and log and display system fault history. These are:

— resident diagnostic programs

— interactive nonresident diagnostic programs

— History File

— user reports

Resident programs

Meridian 1 resident programs are diagnostic and administration programs that continuously monitor system operation and report faults and generate system messages, which are displayed on the system terminal or printed on a system printer. These system messages are listed in *X11 input/output guide (553-3001-311).*

These messages are:

— maintenance display codes listed under HEX that indicate status and error conditions in the system

— maintenance messages listed under XMI in Appendix A and reported to the terminal over the MMI port that indicate status and faults with Fibre Remote IPE equipment

— error messages listed under ERR that indicate hardware faults and under BUG that indicate software faults

— overload messages that indicate faulty peripheral cards listed under OVD

— error messages listed under PWR that indicate power faults

— fault history file that can be printed and reviewed to identify fault events leading to the present status

Resident administration programs provide automatic system administration routines that facilitate system initialization and fault recovery.

These are:

— overlay loader program that finds, loads, and executes all nonresident programs selected to run as midnight and background routines

— system loader program that downloads the call processing programs and starts checking main memory when executing sysload

— system initialization program that automatically starts after the system loader program completes the downloading process and outputs the initialization messages listed under INI in *X11 input/output guide (553-3001-311)*

Nonresident programs

Nonresident programs can be interactive or automatically executed programs. These programs are stored on the system hard disk or floppy disks and are downloaded by the overlay loader program to system memory on demand or at a predetermined time of day such as for midnight and background routines testing.

You can access interactive programs through a maintenance terminal or a maintenance telephone, as described in this chapter. These programs are used to:

— test the equipment and place lines and trunks out of service when testing or faulty and back into service when testing is completed or the line or trunk has been repaired or replaced

— verify the status of a fault

— verify that a fault has been corrected and the equipment is operating correctly

You can select a number of nonresident diagnostic programs by using Configuration Record Program LD 17. This is a program that selects other diagnostic programs and executes them automatically as midnight and background routines. These programs test the entire system and print a report that lists the test results.

You can also manually select continuity tests that check continuity between the Fibre Superloop Network card and the Fibre Peripheral Controller card, as well as other network and peripheral controller cards. You can specify these tests in Background Signaling and Switching Diagnostics LD 45.

Superloop and Controller cards maintenance commands

The maintenance commands of the NT1P61 Fibre Superloop Network card and NT1P62 Fibre Peripheral Controller card are identical to those of the standard NT8D04 Superloop Network and NT8D01 Peripheral Controller cards. These commands are used to manipulate the operational status and perform diagnostic tests on these cards. These commands are located in Network and PE Diagnostic LD 32, which can be accessed using the administration terminal or the maintenance telephone.

Table 8 lists superloop maintenance commands provided by Network and PE Diagnostic LD 32.

Table 8
Meridian 1 network superloop maintenance commands

Maintenance command	Maintenance command description
DISL loop	Disables network loop
ENLL loop	Enables network loop
DISS l s	Disables a shelf or module
ENLS l s	Enables a shelf or module
DSXP x	Disables Peripheral Controller and all IPE cards
ENXP x	Enables Peripheral Controller and all IPE cards
ENXP XPEC x	Enables Peripheral Controller but not IPE cards
STAT loop	Displays status for one or all network loops
SUPL loop	Prints data for one or all superloops
XNTT loop	Self-test on a Network card for a specific loop
XPCT x	Self-test on Peripheral Controller x
XPEC x	Prints data for Peripheral Controller x

Fibre Remote IPE MMI maintenance commands

Fibre Superloop Network card and Fibre Peripheral Controller card provide a man-machine interface (MMI) port to connect a configuration and maintenance terminal. Through this terminal, you can directly issue commands to these cards to test and maintain Meridian 1 fibre-optic equipment including the fibre-optic link.

Table 9 list these commands. However, for a detailed description of these commands, refer to Appendix A in this document, where they are listed in alphabetical order.

Table 9 lists MMI commands directly issued to the system over the MMI terminal. They can be connected to the Fibre Superloop Network card and the Fibre Peripheral Controller card MMI port.

Table 9
MMI maintenance commands (Part 1 of 2)

Maintenance command	Maintenance command description
HELP	Displays the list of MMI commands
<esc>L	Changes the MMI terminal to Local mode
<esc>R	Changes the MMI terminal to Remote mode
SUBM R	Places the Fibre Superloop Network card in Remote mode
SU R	Sets Fibre Superloop Network card in Remote mode when the MMI port is connected to an SDI port
SDEF L/R	Sets the default mode to Local or Remote
QDEF	Checks the default mode of the MMI port
STAD dd mm yy hh mm ss	Sets time and data
TTAD	Checks time and date
SUBM string	Sends a command to the other side of the link, where string = actual command
PLOG{n}	Prints n messages from a log file

Table 9
MMI maintenance commands (Part 2 of 2)

Maintenance command	Maintenance command description
NLOG {n}	Prints the next n messages from a log file
CLOG	Clears the log file
STAT	Checks the card status
IDC M/P/S	Checks the card ID for the main board, the primary packlet, or the secondary packlet
SXSM n	Sets system monitor port number for the wall-mounted Fibre Remote IPE
QXSM	Checks the system monitor port number
TEST P/S	Tests the main card if a parameter is not specified (card must be disabled). Test idle primary packlet if P is specified, or test idle secondary packlet if S is specified. When testing a packlet, the packlet must be idle but the card can be enabled and active.
SVER version	Sets PSDL version that matches the card version. It should also match the loadware version of the standard Superloop Network or Peripheral Controller card.
QVER	Checks the firmware and loadware version
QFIB	Checks the status of fibre-optic links
MANS PRI/SEC	Manual switch to primary or secondary link
FORC PRI/SEC	Forced switch to primary or secondary link
MCLR	Clears manual switch, resumes automatic backup

History File

Meridian 1 can be equipped with the History File feature, which allows the system to store events such as:

— service changes

— maintenance messages

— software errors

— initialization and system download messages

— traffic messages

These messages can be printed and analyzed to identify the events that led to the status. You can select the type of messages you wish to store. For information on how to select messages to be logged into the History File, refer to *X11 features and services (553-3001-306)*.

User reports

User reported faults may give you a clue of what failed in the system. These are:

— major alarms reported by attendant

— calls with no ringing or no dial tone

— trouble with calls in specific Fibre Remote IPE modules

— trouble with specific terminals

— calls that cannot be transferred, and so on

Using maintenance programs

To use Meridian 1 maintenance programs, you must access Meridian 1 using a maintenance terminal or maintenance telephone.

Logging in on the maintenance terminal

To access the program, you must enter a valid password. To do this, type **LOGI** and press the Enter key. The following appears:

```
PASS?
```

Type your password and press the Enter key. Blanks will appear on the screen as you type your password. If you see:

```
OVL015
>
```

you entered an invalid password. Type your password again and press the Enter key. If you entered a valid password, you will see:

```
>
```

This means you are logged in. You are now communicating with Meridianþl and can access the program.

Accessing the program

To access any program on Meridian 1, type LD followed by a space and the program number after the > prompt and press the Enter key.

For example, to access Network and PE Diagnostic Program LD 32, type **LD 32** after the **>** prompt and press the Enter key. At the prompt, type the command you wish to execute.

If for example, you wish to enable network loop 3 that is supported by a Fibre Superloop Network card, at the prompt type:

```
.ENLL 3
```

This will attempt to enable the Fibre Superloop Network card supporting network loop 3.

Responding to error messages

If you enter incorrect information after a prompt, the program displays a warning message or an error message. The prompt is displayed again below the error message so you can enter the correct information.

Exiting the program

To exit the program, type ******** and press the Enter key. You see

```
>
```

This means that you have successfully exited the program. Now, you can either access another program or log out.

Logging out

After you exit the program, you should log out. To do this, type **LOGO** at the **>** prompt and press the Enter key.

Logging in and using a maintenance telephone

You can use a telephone as a maintenance terminal if you define its class-of-service as MTA (maintenance set allowed) in Telephone Set Program LD 11. This feature allows you to access diagnostic programs in Meridian 1 and execute a limited set of maintenance commands to test system functions.

To enter commands on a maintenance telephone you have to use its key pad. The numbers on the key pad represent numbers and letters that you normally use on a video display terminal keyboard.

Table 10 shows the translation from a terminal keyboard to a telephone key pad.

Table 10
Keyboard to key pad translation table

Terminal keyboard			Telephone key pad
		1	1
A	B	C	2
D	E	F	3
G	H	I	4
J	K	L	5
M	N	O	6
P	R	S	7
T	U	V	8
W	X	Y	9
		0	0
		Space or #	#
		Return	##

To use a diagnostic program on Meridian 1:

1 Press the prime DN key.

2 Place the telephone in maintenance mode by entering **xxxx91** on the key pad, where **xxxx** is the customer's Special Prefix number (SPRE) as defined in LD 15. Normally xxxx is 1, thus, you would enter **191**.

3 Enter ** to check if the communication link is idle.

4 If you detect a busy tone, Meridian 1 is in session with another maintenance or administration terminal. Enter **** to force the other terminal to log out. If you do not detect a busy tone, Meridian 1 is idle and you can automatically access Meridian 1.

5 Enter **53#xx##** to load a diagnostic program, where **xx** is the program number. For example, to load Network and PE Diagnostic Program LD 32, you would enter **53#32##**.

6 Perform the maintenance tasks by executing the maintenance commands resident in the program you loaded. For example, from Network and PE Diagnostic Program LD 32 you can disable a fibre network loop by executing (**DISL loop**), where loop is the Fibre Superloop Network card loop, say 3. To execute this command, enter on the key pad **3475#3##**.

7 Press the Release key to log out.

Isolating and correcting faults

Now that you are familiar with the troubleshooting tools, you can begin troubleshooting Fibre Remote IPE equipment. Based on whether Fibre Remote IPE equipment has just been installed and is not yet operational or it had been operating correctly and is now faulty, you can determine what may be the most probable cause of failure.

Types of faults

Problems can occur in the following areas:

— Hardware

— Configuration

— Software

The types of faults you must isolate and correct depend on when the faults occur during installation or in a previously operating system. For example, in a newly installed system, the fault may be in any or all of the three areas; however, in a previously operating system, the fault will probably be in the hardware.

Fault isolation steps

The following steps show you how to isolate system and Fibre Remote IPE faults using the diagnostic tools described in this chapter:

1 Observe and list the problem symptoms the system is exhibiting. Typical symptoms can include the: Fibre Superloop Network card or Fibre Peripheral Controller cards lighting their red LEDs on, the Fibre Peripheral Controller card faceplate display showing a fault code, or the Electro-optical interface LEDs indicating no transmission on the fibre-optic link. Others include common equipment or power supplies having their green LEDs turned off, maintenance codes being displayed on some of the common equipment, network cards displaying codes that indicate faults, and so on.

2 Note whether Fibre Remote IPE was just installed and has not been operating, or if it has been operating correctly and is now faulty. Based on this, refer to "Newly installed Fibre Remote IPE" on page 117 or "Previously operating Fibre Remote IPE" on page 117 for lists of the most common problems.

3 Take the action recommended by the fault isolation and correction tables, which will guide you through fault isolation steps and recommend what test procedures to use.

4 If after following the diagnostic procedures Fibre Remote IPE still does not operate correctly, contact your field service representative.

Newly installed Fibre Remote IPE

Problems that occur during the installation of an entire system, including the Fibre Remote IPE, are usually caused by:

— improperly installed cards

— loose or improperly connected external communication cables, fibre-optic patchcords, or fibre-optic link cables

— incorrect software version

— incorrect Fibre Remote IPE configuration

These types of problems may also occur when:

— installing additional Fibre Remote IPE equipment into an already operating system

— installing a new software version or changing Fibre Remote IPE configuration

Check the symptoms listed in Table 12 that are related to problems with a newly installed Fibre Remote IPE.

Previously operating Fibre Remote IPE

Problems that occur during the normal operation of Fibre Remote IPE are usually caused by:

— faulty equipment

— accidental disconnection of cables

— improper environmental conditions

Check the symptoms listed in Table 12 that are related to problems with a previously operating Fibre Remote IPE.

Meridian 1 fault isolation and correction

To isolate Fibre Remote IPE faults in the Meridian 1 system, you must first isolate and correct the common, the network, and the power equipment faults to make Meridian 1 non-Fibre Remote IPE functions operational. You can then proceed with fault isolation and fault correction of Fibre Remote IPE functions.

To aid you in isolating the problems in a systematic way, use the fault isolation and correction tables. These tables guide you through logical steps to determine the cause of the problem based on the visual fault indicators and system fault messages you see.

Table 11 lists Meridian 1 problem symptoms, a diagnosis of the problem based on the observed symptoms, and the recommended solution to the problem.

Table 11
Meridian 1 common and network equipment problems (Part 1 of 2)

Symptoms	Diagnosis	Solution
Green LEDs on the power equipment are off.	Power source lost, power defective, or disconnected power cables.	Check the power source, circuit breakers, and power cables. Refer to *Meridian 1 fault clearing (553-3001-510)* to correct the problem.
Maintenance terminal displays PWRxxxx messages.	Power supply, Power Distribution Unit, or Blower/Fan unit defective.	Refer to *X11 input/output guide (553-3001-311)* for a list of PWR messages. Also refer to Appendix A for wall mounted cabinet PWRxxxx HW SM UEM U message format. Based on the message, take the appropriate action to resolve the problem.
Some red LEDs on the common, network, and/or peripheral equipment are on and call processing has stopped.	Common or network equipment cards faulty. Peripheral equipment cards faulty.	Observe the error messages on the terminal and check for ERR and/or BUG messages listed in *X11 input/output guide (553-3001-311)*. Use this information to locate and correct the fault. Refer to *Meridian 1 fault clearing (553-3001-510)*.

Table 11
Meridian 1 common and network equipment problems (Part 2 of 2)

Symptoms	Diagnosis	Solution
Maintenance terminal displays OVDxxxx messages.	Superloop Network Card, Network Card, and/or Peripheral Signaling Card are disabled.	Observe the OVD messages on the terminal and check the description of these messages listed in *X11 input/output guide (553-3001-311)*. Use this information to locate and correct the fault. Refer to *Meridian 1 fault clearing (553-3001-510)*.
Maintenance display codes on the CPU cards and storage devices show fault codes.	Common equipment disk drives hardware faults, memory faults, or interrupt faults.	Refer to *X11 input/output guide (553-3001-311)* for a list of all the HEX codes. Based on the maintenance display codes description, take the appropriate action and resolve the problem.
Maintenance display codes on network cards show faults.	Indicates bus error or card problem.	Reinsert the card and observe the self-test codes. Refer to *X11 input/output guide (553-3001-311)* for a list of all self-test codes and their description. If the problem remains, replace the card.
Major or minor alarms.	Common, network, and/or peripheral equipment failure.	Refer to *Meridian 1 fault clearing (553-3001-510)* to identify the cause of alarm. Check the history file.

After you isolate and correct common equipment and network equipment faults, all the other system and card faults may clear and the system may start operating normally. If this does not occur, you must proceed with troubleshooting Fibre Remote IPE equipment as described in "Fibre Remote IPE fault isolation and correction" on page 120.

If you cannot resolve the problem after exhausting all the available diagnostic tools and test procedures, make a list of all the symptoms you observed and contact your field service representative.

Fibre Remote IPE fault isolation and correction

After Meridian 1 non-Fibre Remote IPE system functions are operating correctly, you can proceed with fault isolation and fault correction of Fibre Remote IPE equipment.

Table 12 deals specifically with Fibre Remote IPE service problems. To diagnose these problems, the table refers you to the test procedures in this manual that will most likely be able to resolve them.

Table 12
Meridian 1 Fibre Remote IPE equipment problems (Part 1 of 2)

Symptoms	Diagnosis	Solution
Red LED on the Fibre Superloop Network card or Fibre Peripheral Controller card permanently on.	Card is disabled or faulty.	Go to *Procedures 1, 2,* and *5* in this chapter to check the card status and perform self-test. Also enter the **STAT** command on the MMI terminal to check the card status.
LED on the Electro-optical packlet is on.	Fibre-optic link is in red alarm state and there is no communication over the link.	Check fibre-optic link connections and go to *Procedure 3* to test the link using the loopback test.
Link is OK but no communication with the system monitor.	System monitor address incorrect.	Define a unique address correctly. Observe the XMI messages on the MMI terminal and check the description of these messages listed in *Appendix A*. Use this information to locate and correct the fault.
Display on the Fibre Peripheral Controller card shows fault codes.	Card faulty: failed self-test or problem communicating with peripheral equipment.	Go to *Procedures 4* and *6* to check tracking and loopback. Also refer to *X11 input/output guide (553-3001-311)* for a list of codes. Based on the maintenance display codes description, take the appropriate action and resolve the problem.

Table 12
Meridian 1 Fibre Remote IPE equipment problems (Part 2 of 2)

Symptoms	Diagnosis	Solution
Error messages printed on the MMI terminal or the Meridian 1 TTY.	Hardware or software problems with the Fibre Remote IPE.	Note various error messages. Refer to *Appendix A* in this manual and *X11 input/output guide (553-3001-311)* for a list of these messages and their description. Based on the code's description, take the appropriate action to resolve the problem.
Red alarm is displayed on the TTY.	Fibre network and/or peripheral equipment failure.	Query the status on the fibre-optic links by entering the **QFIB** command at the MMI terminal.

If you cannot resolve the problem after exhausting all available diagnostic tools and test procedures, make a list of the symptoms and contact your field service representative.

Fibre Superloop Network card fault isolation and correction

The NT1P61 Fibre Superloop Network card provides a communication interface between the CPU and the Fibre Peripheral Controller card.

The Fibre Superloop Network card processes signaling information and data received from the Fibre Peripheral Controller card over the fibre-optic link.

Problems with the Fibre Superloop Network card may be caused by hardware faults, incorrect configuration, a disabled Fibre Superloop Network card, or continuity problems between the card and other network cards connected to the network bus. To isolate and correct problems with the Fibre Superloop Network card, follow the procedures below.

Procedure 1
Checking the status of Fibre Superloop Network card

The diagnosis in Table 12 indicates that the Fibre Superloop Network card may be faulty or disabled. The first step in identifying the problem is to verify the status of the Fibre Superloop Network card. The status of a Fibre Superloop Network card is obtained by executing the **STAT loop** command in Network and Signaling Diagnostic Program LD 30.

To obtain the Fibre Superloop Network card status:

1. Log in on the maintenance terminal as described in "Using maintenance programs" on page 112 in this document.
2. At the > prompt, type **LD 30** and press the Enter key to access the Network and Signaling Diagnostic Program LD 30.
3. Type **STAT loop** and press the Enter key, where **loop** is the loop number of the Fibre Superloop Network card you are testing.
4. If the response is UNEQ = then the loop is not equipped (the Fibre Superloop Network card is not installed).

5 If the Fibre Superloop Network card is manually disabled using LD 30, the response can be:

DSBL: NOT RESPONDING = the loop is disabled and the card is not responding (the card is missing, disabled by the EBL/DIS switch, or faulty).

DSBL: RESPONDING = the loop is disabled and the card is responding (the card is disabled with DISL command, the Peripheral Signaling card is disabled, or an overload condition exists).

Note: Overload conditions are indicated by OVDxxx messages. Refer to *X11 input/output guide (553-3001-311)* for the message description and indication of the problem.

x BUSY, y DSBL = the loop is enabled with x channels busy and y channels disabled.

CTYF L1 L2... = loop specified in STAT command cannot receive speech from one or more loops or there is a possible continuity test failure due to a faulty network card such as the Fibre Superloop Network card.

Type **ENLL loop** and press the Enter key to enable the loop, where **loop** is the Fibre Superloop Network card loop number. A message indicating that the Fibre Superloop Network card is enabled and working is displayed on the console. Also observe the red LED on the Fibre Superloop Network card. If it turns off, the Fibre Superloop Network card is functioning correctly. If the LED continues to stay on, the Fibre Superloop Network card probably failed self-test and a message should be displayed on the maintenance terminal to that effect.

If the message indicates that the Fibre Superloop Network card is faulty, replace the card.

Procedure 2
Performing the Fibre Superloop Network card self-test

If the NT1P61 Fibre Superloop Network card appears faulty, you should conduct the self-test to verify that it is actually faulty before you replace it. This test verifies the basic Fibre Superloop Network card functions and outputs a fail or pass message after the test is completed.

To perform the self-test, follow the steps below:

1 Log in on the maintenance terminal as described in "Using maintenance programs" on page 112 in this document.

2 At the > prompt, type **LD 32** and press the Enter key to access the Network and PE Diagnostic Program.

3 Type **DISL loop** and press the Enter key to disable the Fibre Superloop Network card, where **loop** is the Fibre Superloop Network card loop number you are disabling.

4 Type **XNTT loop** and press the Enter key to start the self-test, where **loop** is the Fibre Superloop Network loop number specified for self-test.

If the response is:

TEST PASSED

The Fibre Superloop Network card passed the self-test and is functional; it must be enabled to turn off the red LED and to start processing calls.

If the Fibre Superloop Network card passed the self-test, but the problem persists, the loop or other cards that interface with the Fibre Superloop Network card may be faulty. To verify the integrity of the network bus and connections between the Fibre Superloop Network card and other network and peripheral equipment cards interfacing with the Fibre Superloop Network card, go to Procedure 3.

If the response is

TEST FAILED REASON: xxxx

XPE0 {NOT} CONNECTED

XPE1 NOT CONNECTED

The Fibre Superloop Network card failed the self-test and is faulty, where **xxxx** can be one of the following values:

0–ROM checksum failed
1–FLASH checksum failed
2–A21 #1 faulty
3–A21 #2 faulty
4–R71 faulty
Replace the Fibre Superloop Network card as described in Replacement procedures. NPRxxx message may be displayed as a result of a command activated self-test if the Fibre Superloop Network card is missing, not configured, and so on.

5 Exit LD 32 by typing **....** at the prompt.

Procedure 3
Performing the Fibre Superloop Network loopback tests

If the NT1 P61 Fibre Superloop Network card self-test indicates that the card is not faulty, you should conduct loopback tests to isolate the problem that may exist on network cards, network buses, or fibre-optic link connections between the Fibre Superloop Network card and the Fibre Peripheral Controller card.

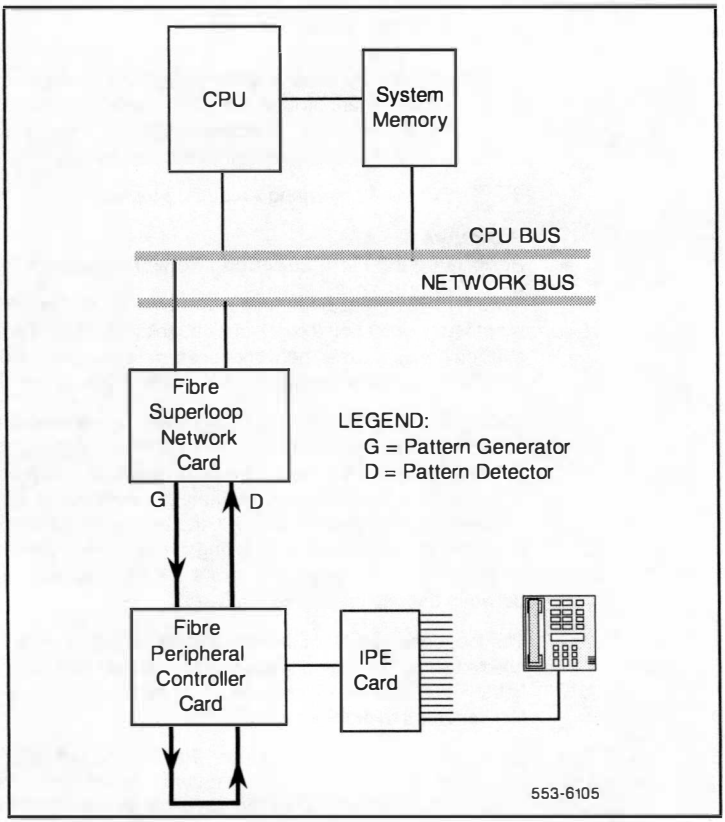
Loopback tests check the continuity between various interface points in the system. This is performed by sending a known signal pattern from the originating point to the destination and receiving it back at the originating point or a designated detecting point. If the pattern is detected and it matches the transmitted pattern without errors, the test verifies that the tested equipment and their connections are operating correctly. However, if the pattern is not detected or it is detected with errors, the equipment or the connections between the equipment are faulty.

The loopback uses the Fibre Superloop Network card as a pattern generator and detector. The signal is transmitted by the Fibre Superloop Network card to the Fibre Peripheral Controller card and looped back to the Fibre Superloop Network card over the fibre-optic link.

Note: For a Fibre Remote IPE with the redundant fibre-optic link, the loopback is automatically routed over the functioning link, not the faulty link. To identify the Electro-optical packlet that may be faulty, you can perform the packlet test at each end of the link by following the instructions in step 6 of this Procedure.

Figure 21 illustrates the loopback path and shows the Fibre Superloop Network card as a test pattern generator and detector.

Figure 21
Loopback path for XCON test 6



To start the loopback test:

1 Log in on the maintenance terminal as described in "Using maintenance programs" on page 112 in this document.

2 At the > prompt, type **LD 45** and press the Enter key to access the Background Signaling and Switching Program.

3 Select test condition:

— Enter XCON 0 and press the Enter key if you wish to perform only one loopback test.

— Enter one test period shown in XCON H 1-255, M 1-255, Sþ1-255 and press the Enter key to select continuous loopback testing for a selected time link, where Hþ1-255 is 1 to 255 hours, M 1-255 is 1 to 255 minutes, and S 1-255 is 1 to 255 seconds.

Example: XCON M 5 specifies the duration of the test to be 5 minutes.

4 At the TEST prompt, type **6** and press the Enter key. Continue responding to the prompts to configure the loopback test as follows:

Command	Range	Description
TEST	6	XCON test number
PATT	0–7	Signal pattern
TYPG	N	Fibre Superloop Network card—generator
SUPL	0–156	Superloop in multiple of 4
SLOT	xx	Timeslots 2–31, 34–63, 66–95, 98–127
TYPD	N	Fibre Superloop Network card—detector
SUPL	0–156	Superloop in multiple of 4
LBTY	P	Loopback through Fibre Controller
LBTN	l1 s 99	Special Fibre Controller loopback channel
TAG x	0–15	Tag number assigned by the system

5 Check the loopback test results. The results are automatically displayed if you specified XCON 0 test conditions; otherwise, you must specify XSTA or XSTP with the test TAG number to check the status. XSTA gets the status of the manual continuity test and XSTP stops the manual continuity test. If the results show BSDxxx messages, refer to the list and description of these messages in *X11 input/output guide (553-3001-311)*. The BSDxxx messages indicate the possible causes of the problem, which you should check to isolate the actual problem.

— If the loopback continuity test passes, the problem may be somewhere in the IPE cards.

— If the loopback continuity fails, go to Procedure 3.

6 Perform the Electro-optical packlet test by using the MMI terminal or TTY at each end of the link:

— From the MMI terminal execute the **TEST P/S**, where **P** = primary packlet and **S** = secondary packlet

— Connect the transmit port to the receive port with a short fibre-optic patchcord on the Electro-optical packlet being tested.

— The packlet is operating correctly if the red LED turns off and stays off during the test with the patchcord installed. Otherwise, the packlet is faulty and should be replaced.

— Repeat step 6 for the other end of the link.

Fibre Peripheral Controller card fault isolation and correction

The NT1P62 Fibre Peripheral Controller card provides a communication interface between the Fibre Superloop Network card and the IPE cards housed in the Fibre Remote IPE module or cabinet.

Problems with the Fibre Peripheral Controller card may be caused by hardware faults, incorrect configuration, a disabled Fibre Peripheral Controller card, or continuity problems between the card and IPE cards connected to the peripheral bus. To isolate and correct problems related to the Fibre Peripheral Controller card, follow the procedures below.

Procedure 4
Checking the Fibre Peripheral Controller card tracking status

The Fibre Peripheral Controller card can display tracking information, which shows the status of the Fibre Peripheral Controller card phase-lock loop and to what clock source it is locked. To obtain this information, execute the **RPED l s** command in Network and Signaling Diagnostic Program LD 30.

To obtain the Fibre Peripheral Controller card tracking status:

1 Log in on the maintenance terminal as described in "Using maintenance programs" on page 112 in this document.

2 At the **>** prompt, type **LD 30** and press the Enter key to access the Network and Signaling Diagnostic Program LD 30.

3 Type **RPED l s** and press the Enter key, where **l** is the loop number of the Fibre Superloop Network card and **s** is the shelf or module you are testing.

The Fibre Peripheral Controller card may return one of the following codes:

C0—clock is locked on the primary Electro-optical packlet

C1—clock is locked on the secondary Electro-optical packlet

4 Exit LD 30 by typing **....** at the prompt.

5 Check the incoming signal. If present, replace the packlet; otherwise, find the problem on the link.

Procedure 5
Performing the Fibre Peripheral Controller card self-test

If the Fibre Peripheral Controller card appears faulty, you should conduct the self-test to verify that it is actually faulty before you replace it. This test verifies the basic Fibre Peripheral Controller card functions and outputs a fail or pass message after the test is completed. During self-test the Fibre Peripheral Controller card displays HEX messages indicating the test performed. To identify the codes displayed, refer to Table 14.

To perform the self-test, follow the steps below:

1 Log in on the maintenance terminal as described in "Using maintenance programs" on page 112 in this document.

2 At the > prompt, type **LD 32** and press the Enter key to access the Network and PE Diagnostic Program.

3 Type **DSXP x** and press the Enter key to disable the Fibre Peripheral Controller card, where **x** is the Fibre Peripheral Controller card you are disabling.

4 Type **XPCT x** and press the Enter key to start the self-test, where **x** is the Fibre Peripheral Controller card specified for self-test.

If the response is:

TEST PASSED

The Fibre Peripheral Controller card passed the self-test and is functional. It must be enabled to turn off the red LED and start processing calls.

Type **ENXP x** and press the Enter key to enable the card.

If the Fibre Peripheral Controller card passed the self-test, but the problem persists, the link or other cards that interface with the Fibre Peripheral Controller card may be faulty. To verify the integrity of the peripheral bus and the Fibre Peripheral Controller card, go to Procedure 6.

If the response is:

TEST FAILED REASON: xxxx

The Fibre Peripheral Controller card failed the self-test and is faulty, where **xxxx** specifies the cause of the fault. An NPRxxx message may be displayed as a result of a command activated self-test if the Fibre Peripheral Controller card is missing, not configured, and so on.

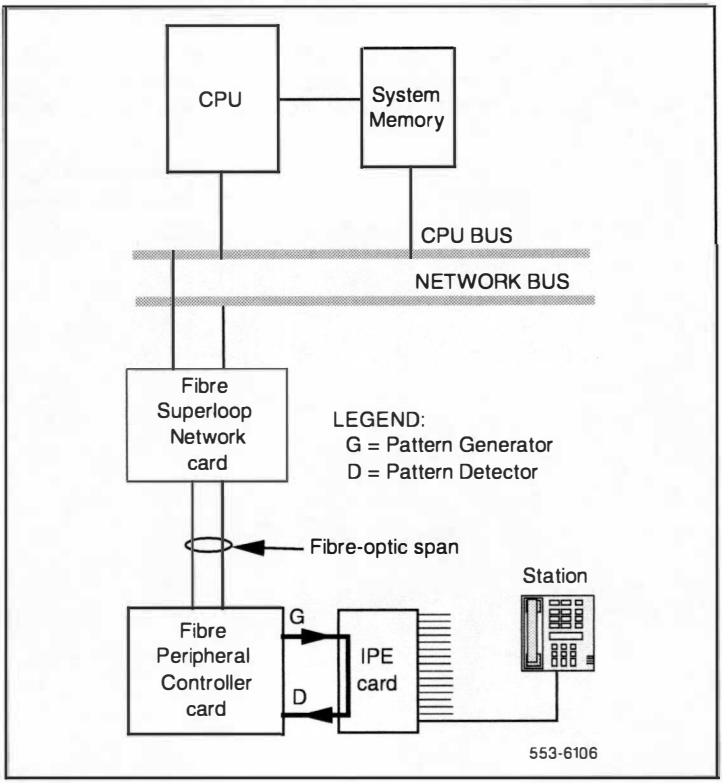
5 Exit LD 32 by typing •••• at the prompt.

Procedure 6
Performing the Fibre Peripheral Controller card loopback test

The loopback uses the Fibre Peripheral Controller card as a pattern generator and detector. The signal is transmitted by the Fibre Peripheral Controller card back to the Fibre Peripheral Controller card over a special loopback channel on the peripheral bus.

Figure 22 illustrates the loopback path and shows the Fibre Peripheral Controller card as a test pattern generator and detector.

Figure 22
Loopback path for XCON test 7



To perform the loopback test:

1 Log in on the maintenance terminal as described in "Using maintenance programs" on page 112 in this document.

2 At the > prompt, type **LD 45** and press the Enter key to access the Background Signaling and Switching Program.

3 Select test condition:

— Enter XCON 0 and press the Enter key if you wish to perform only one loopback test.

— Enter one test period shown in XCON H 1-255, M 1-255, S 1-255 and press the Enter key to select continuous loopback testing for a selected time link, where H 1-255 is 1 to 255 hours, M1-255 is 1 to 255 minutes, and S 1-255 is 1 to 255 seconds.

Example: XCON M 5 specifies the duration of the test to be 5 minutes.

4 At the TEST prompt, type 7 and press the Enter key. Continue responding to the prompts to configure the loopback test as follows:

Command	Range	Description
TEST	7	XCON test number
PATT	0–7	Signal pattern
TYPG	P	Fibre Peripheral Controller card—generator
TN	l s 99 0	Special Fibre Peripheral Controller loopback channel
TAG x	0–15	Tag number assigned by the system

5 Check the loopback test results. The results are automatically displayed if you specified XCON 0 test conditions; otherwise, you must specify XSTA or XSTP with the test TAG number to check the status. XSTA gets the status of the manual continuity test and XSTP stops the manual continuity test. If the results show BSDxxx messages, refer to the list and description of these messages in *X11 input/output guide (553-3001-311)*. The BSDxxx messages indicate the possible causes of the problem, which you should check to isolate the actual problem.

— If the loopback continuity test passes, the problem may be somewhere in the IPE cards.

— If the loopback continuity fails, replace the card.

Fault isolation and correction using MMI maintenance commands

You can perform some testing and troubleshooting of the Fibre Remote IPE from a local or a remote MMI terminal or TTY by typing MMI commands on the terminal without loading system diagnostic programs (overlays).

These commands provide current equipment status, invoke card testing, check equipment performance, print messages from log files, and so on.

Procedure 7
Checking Fibre Remote IPE using MMI commands

This procedure uses MMI commands to maintain Fibre Remote IPE cards, and fibre-optic link status.

You can send these commands from the local MMI terminal to be executed by the remote site MMI terminal and vice versa by executing the **SUBM string** command, where string is the actual command sent to the other side.

For example, **SUBM PLOG 10** entered at the local MMI terminal will request that the remote site prints 10 messages from the log file located in the Fibre Peripheral Controller card memory.

To obtain the Fibre Superloop Network and Fibre Peripheral Controller cards status:

1 Log in on the MMI maintenance terminal.

2 Type **STAT** to check the status or the card connected to the MMI terminal.

The response:

Enabled/Disabled PLL: lock/unlock prim/sec

The card is enabled by the CPU, when enabled. The phase-lock loop can be locked to the incoming signal or not, and the PLL may be locked on the primary or secondary packlet.

3 Type **TEST P/S** and press the Enter key, where **P** tests the primary packlet and **S** tests the secondary packlet.

The response is one of the self-test messages listed in Appendix A.

4 Type **QFIB** and press the Enter key to query the status of the fibre-optic link.

The response:

PRIM physical/signal/direction
SEC physical/signal/direction

physical represents the status of the Electro-optical packlet, which can be **equipped, unequipped**, or **faulty**.

signal represents the status of the incoming signal, which can be **SF** (signal failed), **SD** (signal degrade not implemented in Rev 1 H/W), or **NA** (no alarm).

direction represents the direction of traffic on the link, which can be **incoming, outgoing, bothways**, or **none**.

5 Type **QALM** and press the Enter key to query the alarm status of the fibre-optic link.

The response:

PRIM alarm type
SEC alarm type

alarm on the Electro-optical packlet can be **red** (local alarm), **yellow** (remote alarm), or **clear** (no alarm).

type indicate one of the following types of alarm when it exists: **LOS**, **LOF**, **LOP**, or **FERF**.

6 Type PRPM {prim/sec} and press the Enter key to print the Performance Monitoring report for the primary and secondary fibre-optic links.

The format of the response is shown in Table 13.

Table 13 shows the format for the Performance Monitoring report. The report shows a matrix or fibre-optic link performance parameter values for different interval counters listed in the header and intervals listed in the first column.

Table 13
Performance Monitoring report form

link: prim/sec				**date: *mm/dd/yy***			**time: *hh/mm***	
Interval	**Section**				**Line**			
	SEFS	**CV**	**ES**	**SES**	**CV**	**ES**	**SES**	**PSC**
C	n	n	n	n	n	n	n	n
1	n	n	n	n	n	n	n	n
2	n	n	n	n	n	n	n	n
3	n	n	n	n	n	n	n	n
4	n	n	n	n	n	n	n	n
CD	n	n	n	n	n	n	n	n
PD	n	n	n	n	n	n	n	n

Section parameter description:

SEFS (Severely Errored Framing Seconds) indicates the number of seconds when at least one out-of-frame (OOF) or one change of frame alignment (COFA) occurred.

CV (Section Coding Violations) counts section BIP-8 violations in the STS-3 frame.

ES (Section Errored Seconds) indicates a second during which at least a coding violation (CV), an out-of-frame (OOF), or a change of frame alignment (COFA) occurred.

SES (Section Severely Errored Seconds) counts the number of seconds when et least 16 coding violations (CV), an out-of-frame (OOF), a change of frame alignment (COFA), or loss-of-signal (LOS) occurred

Line parameter description:

CV (Line Coding Violations) counts all line BIP-8 violations over all STS-3 frames.

ES (Section Errored Seconds) indicates a second during which at least a coding violation (CV) or a line alarm indication signal (AIS) state was detected.

SES (Section Severely Errored Seconds) counts the number of seconds with et least 32 line coding violations (CV) when the line alarm indication signal (AIS) state was detected.

PSC (Protection Switching Counts) counts the number of times when link protection switching occurred due to signal fail (SF) or signal degrade (SD) condition.

Interval parameter description:

C (Current interval) is the status of section and line parameters at the time interval when the Performance Monitoring report is issued.

1 through **4** are subsequent four intervals

CD is current day or the day the report was issued

PD is previous day or the day before the report was issued.

Replacing Fibre Remote IPE cards

If after completing troubleshooting you determine that one or more Fibre Remote IPE cards are defective, you will have to remove them and replace them with spares. When you insert a spare Fibre Superloop Network card or Fibre Peripheral Controller card in the module or wall-mounted cabinet, observe the card LED (the uppermost LED on the faceplate) to determine if the card passed self-test. Package and ship the defective cards to an authorized repair center.

Unpacking replacement cards

Unpack and visually inspect replacement cards as follows:

1. Inspect the shipping container for damage. Notify your distributor if you find that the container is damaged.
2. Remove the unit carefully from the container. Do not puncture or tear the container—use a utility knife to open it. Save the container and the packing material for shipping the defective card.
3. Visually inspect the replacement card for obvious faults or damage. Report the damage to your sales representative.
4. Keep cards in their antistatic bags until you are ready to install them. Do not stack them on top of each other.
5. Install cards. When handling the cards, hold them by their nonconducting edges to prevent damage caused by static discharge.

Removing and replacing a card

A Fibre Remote IPE card can be removed from and inserted into a Meridian 1 module or the Remote IPE module or wall-mounted cabinet without turning off the power to the module or cabinet. This feature allows Meridian 1 to continue normal operation when you are replacing a Fibre Superloop Network card in Meridian 1 or a Fibre Peripheral Controller card in the Remote IPE module or cabinet.

Removing and replacing a Fibre Superloop Network card

1 Disable the Fibre Superloop Network card by logging in to the system terminal, loading the Network and Peripheral Equipment Diagnostic Program LD 32, and executing **DIS loop**, where **loop** is the actual loop number of the Fibre Superloop Network card.

2 Set the ENL/DIS switch to DIS.

3 Disconnect all the fibre-optic patchcords and the SDI/System Monitor cable from the card faceplate.

4 Unlatch the card's locking devices by squeezing the tabs and pulling the upper locking device away from the card and pressing the lower locking device downward.

5 Pull the card out of the network module and place it into an antistatic bag away from the work area.

6 Check the replacement card and make sure that the Electro-optical packlets are already installed. If not installed, install the new packlets or remove the packlets from the faulty Fibre Superloop Network card and install them on the replacement card if you are sure that the packlets are not faulty.

7 Set the replacement card ENL/DIS switch to DIS.

8 Hold the replacement card by the card locking devices and insert it partially into the card guides in the module.

9 Pull the upper locking device away from the faceplate on the card and press the lower locking device downward and insert the card firmly into the backplane connector. Press the upper locking device firmly against the faceplate and press the lower locking device upwards to latch the card inside the module.

10 Set the ENL/DIS switch on the Fibre Superloop Network card to ENL. The Fibre Superloop Network card automatically starts the self-test.

11 Observe the red LED on the front panel during self-test. If it flashes three times and stays on, it has passed the test; go on to step 12. If it does not flash three times and then stays on, it has failed the test. Pull the card partially out of the module and reinsert it firmly into the module. If the problem persists, troubleshoot or replace the Fibre Superloop Network card.

12 Connect the SDI/System Monitor cable and the fibre-optic patchcords to the faceplate connectors of Fibre Superloop Network card.

13 Set the ENL/DIS switch to ENL. If the upper most red LED on the Fibre Superloop Network card faceplate turns off, the card is functioning correctly and is enabled. The outcome of self-test will also be indicated on the system terminal or TTY (or the MMI terminal connected to the SDI/System Monitor connector on the faceplate of the Fibre Superloop Network card). If the LED stays on, go to "Isolating and correcting faults" on page 116 in this document.

14 Tag the defective card(s) with a description of the problem and prepare them for shipment to your equipment supplier's repair depot.

Removing and replacing a Fibre Peripheral Controller card

1 Log in on the maintenance terminal as described in "Using maintenance programs" on page 112 in this document.

2 At the > prompt, type LD 32 and press the Enter key to access the program.

3 Type **DSXP x**, where **x** is the Fibre Peripheral Controller card, and press the Enter key to disable the card. The Fibre Peripheral Controller card is now disabled and you can remove it.

4 Disconnect all the fibre-optic patchcords from the card faceplate.

5 Unlatch the card's locking devices by squeezing the tabs and pulling the upper locking device away from the card and the lower locking device downwards.

6 Pull the card out of the IPE module or cabinet and place it in an antistatic bag away from the work area.

7 Check the replacement card and make sure that the Electro-optical packlets are already installed. If not installed, install the new packlets or remove the packlets from the faulty Fibre Peripheral Controller card and install them on the replacement card if you are sure the packlets are not faulty.

8 Hold the replacement card by the card locking devices and insert it partially into the card guides in the module.

9 Pull the upper locking device away from the faceplate on the card and the lower locking device downwards and insert the card firmly into the backplane connector. Press the upper locking device firmly against the faceplate and the lower locking device upwards to latch the card inside the module. The Fibre Peripheral Controller card automatically starts the self-test.

10 Observe the red LED on the front panel during self-test. If it flashes three times and stays on, it has passed the test. Go to step 11. If it does not flash three times and then stays on, it has failed the test. Pull the card partially out of the module and reinsert it firmly into the module. If the problem persists, troubleshoot or replace the Fibre Peripheral Controller card.

11 Connect the fibre-optic patchcords to the optical connectors of the Fibre Peripheral Controller card faceplate. For a wall-mounted Fibre Remote IPE, plug the fibre-optic link FC/PC optical connectors into the FC/PC optical connectors on the Fibre Peripheral Controller card faceplate.

12 At the: prompt in the LD 32 program, type **ENXP x**, where **x** is the Fibre Peripheral Controller card, and press the Enter key to enable the card. If the uppermost red LED on the Fibre Peripheral Controller card faceplate turns off, the card is functioning correctly and is enabled. The outcome of self-test will also be indicated by LD 32 on the MMI terminal connected to the Fibre Peripheral Controller card. If the LED stays on, go to "Isolating and correcting faults" on page 116 or replace the card.

13 Tag the defective card(s) with a description of the problem and prepare them for shipment to your equipment supplier's repair depot.

Reinstalling covers

When you determine that the Fibre Remote IPE is operating correctly, do the following:

1 Reinstall the covers on Meridian 1 module.

2 Reinstall the cover on the Remote IPE floor-standing module or the wall-mounted cabinet.

3 Terminate you session with Meridian 1 by logging out on your maintenance terminal: type LOGO at the: prompt and press the Enter key. If using the MMI terminal, log out to complete the test and troubleshooting session.

Packing and shipping defective cards

To ship a defective card to a Nortel Networks repair center, you should:

1 Tag the defective card with the description of the problem.

2 Package the defective card for shipment using the packing material from the replacement card. Place the card in an antistatic bag, put in the box, and securely close the box with tape.

3 Obtain shipping and cost information from Nortel Networks and mail the package to an authorized repair center.

Appendix A: System messages and MMI commands description

This appendix lists system messages displayed or printed on the Meridian 1 and MMI terminal or TTY and Fibre Peripheral Controller card HEX messages displayed during selftest on the two-character display located on the Fibre Peripheral Controller faceplate.

It also lists in alphabetical order MMI commands and describes the function of each command.

Table 14
System messages displayed on the system terminal of TTY (Part 1 of 6)

MMI port messages
Chk_Thresh: B1 errors on primary/secondary Transmission degrade: receiver signal contains occasional error at a low rate. If the message repeats, check optical cables, connectors, and optical packlets.
Chk_Thresh: R71 bad idle bytes
Chk_Thresh: R71 crc error threshold exceeded
Chk_Thresh: R71 End of Packet missing
RSIG lost sync error: x
Chk_Thresh: R71 message has been truncated
R71 failure - Reinit All these messages indicate problem with R71 (RSIG) signaling. If problem persists, do selftest.

Table 14
System messages displayed on the system terminal of TTY (Part 2 of 6)

TN read register unblocked, cnt= x	Problem with the Peripheral Signaling interface. Check to see if the Fibre Superloop Network card is seated correctly in its card slot.
FXNET Reset: Power-up/Watchdog/MSL-1 Boot version: xx	Reset caused by the CPU. **xx** is the boot code version. Multiple unassisted power-up resets indicate card, backplane, or supply failure. Watchdog reset may indicate firmware problem.
FXPEC Reset: Power-up/Watchdog/MSL-1 Boot version: xx	Reset caused by the MPU. **xx** is the boot code version. Multiple unassisted power-up resets indicate card, backplane, or supply failure. Watchdog reset may indicate firmware problem
Card ID: string	Prints the card ID stored in the EEPROM.
FXNET/FXPEC Main code version: xx {+pROBE}	This message appears at the end of the boot process.
TSIC Memory Mismatch . . . Rebuild OK	
BRSC Local Switch Memory Mismatch, IVDch = x . . . Rebuild OK	Hardware or firmware fault (switching mechanism). Check to see if the Fibre Superloop Network card is seated correctly in its card slot.
Stuck RSIG	
R71 CRC. cnt = x	
R71 trunc. Cnt = x	
R71 misalign. Cnt = x	
R71 no resync. Cnt = x	All these messages indicate problem with R71 (RSIG) signaling. If problem persists, do selftest to identify the problem, which may be hardware.

Table 14
System messages displayed on the system terminal of TTY (Part 3 of 6)

Self-test messages
Card test started...PASSED! or FAILED! In case of selftest failure, the self-test is restarted and a message is printed to indicate the cause of failure. If the fault persists, replace the card. The system will output a message to identify the fault. Failed component messages and their description are listed as follows: **MPU confidence test failed** The basic confidence test of the MPU of the tested card failed. **MPU int mem test failed: address=*addr* expected=*x* received =*y*** MPU internal memory failed at address=**addr**; **x** is the test pattern when writing, and **y** is the read value. **EPROM test failed: calculated chksum=*checksum*** The data in the boot EPROM is corrupt. The field ***checksum*** is calculated by the MPU. When the EPROM is good the checksum=0. **FLASH EPROM failed: calculated chksum=*checksum*** The data in the FLASH EPROM is corrupt. The field ***checksum*** is calculated by the MPU. When the EPROM is good the checksum=0. **Shared RAM failed: address=*addr* expected=*x* received=*y*** Shared memory failed at address=**addr**; **x** is the test pattern when writing, and **y** is the read value. **Main RAM failed: address=*addr* expected=*x* received=*y*** Shared memory failed at address=**addr**; **x** is the test pattern when writing, and **y** is the read value. **MPU addressing failed** The MPU addressing modes failed the test.

Table 14
System messages displayed on the system terminal of TTY (Part 4 of 6)

EEPROM failed: pattern/address/program	
	EEPROM cannot be reprogrammed. If the test passed, the card ID is printed.
Timer 1 failed	Internal timer in the card selftest failed.
Timer 2 failed	Internal timer in the card selftest failed.
Watchdog timer failed	
	One of the MPU internal timers failed. The timer ID is indicated in the message.
DUART failed	The system monitor port UART is faulty.
A21_1 failed	Network bus interface failed.
A21_2 failed	Network bus interface failed.
RSIG failed: *type*	
	RSIG is faulty. **type** is the type of failed test, which can be **reg** (register), **cont** (continuity), **xcvr** (receivers).
Interrupt failed: vect=*n*	
	MPU interrupt test failed, where **n** is the interrupt vector number that failed.
TSIC failed: *cause*	
	The FXPEC TSIC logic failed, where ***cause*** identifies the cause of failure.
A31 failed: *cause*	
	The FXPEC TSIC logic failed, where ***cause*** identifies the cause of failure.
Electro-optical packlet testing	
Packlet #n equipped! testing...PASSED! or **FAILED!**	
	If the test result is FAILED!, the additional information printed on the TTY can be one of the following:

Table 14
System messages displayed on the system terminal of TTY (Part 5 of 6)

EOI #n failed: *cause*	
	EOI packlet **n** failed and ***cause*** indicates the cause of the fault.
EOI #n loopback failed	
	The loopback test failed on the EOI #n.
P/EEPROM failed: pattern/address/program	
	EEPROM cannot be reprogrammed. If the test passed, the card ID is printed.
General card messages	
FXNET/FXPEC time: HH:MM dd/mm/yy	
	Time stamp is printed every 15 minutes, where HH:MM is hour and minute, dd/mm/yy is the day, month, and year.
Illegal command	Unrecognized command issued by the craftsperson.
Illegal parameter	Incorrect parameter entry.
MMI: string from remote: *string*	
	String is received from the FXPEC, but FXNET is in the MMI mode. ***string*** represents the actual command received from the other side.
MMI: switched to MSL-1 mode	
	SUBM R command was executed at the opposite site to place the MMI terminal in the MSL-1 mode.
PLL locked	FXNET PLL lock was successful.
PLL start bit not ready	
	Problem with PLL. Unplug the card and plug it back in. In the message reappears, replace the packlet.
PLL locked on prim/sec	
	FXPEC successfully locked on the signal from the Electro-optical packlet identified by **prim** or **sec**.
PLL lock lost	PLL is in the process of trying to lock.

Table 14
System messages displayed on the system terminal of TTY (Part 6 of 6)

PWR messages
PWRxxxx HW SM UEM U Where **HW=PWSP** (power supply), **DCSP** (DC battery), **SM**=System monitor address (**1-63**) defined by the FXPEC MMI port. **UEM=0** for the main wall-mounted cabinet and 1 for the expansion wall-mounted cabinet. **U**=unit (not used).
XMI000 *loop message* This is the general format of MMI messages printed on the system TTY. ***loop*** is the superloop number of the FXNET and ***message*** is the text sent by the card.
XMI000 *loop* OIF: switched to prim/sec Indication is that the span switched to primary or secondary link.
XMI000 11 RSIG link lost - Reinitialized **XMI000 11 R71 CRC Error threshold exceeded** Failure of R71 (RSIG) communication to the Fibre Peripheral Controller card.

Table 15
Fibre Peripheral Controller selftest HEX codes (Part 1 of 2)

HEX code	Test description
01	MPU confidence test
02	MPU internal RAM
03	Boot EPROM test
04	RAM test
05	MPU addressing mode test
06	ID EEPROM test
07	FLASH EPROM test (the programmable part)
08	Watchdog timer test
09	MPU timers test
0A	DUART port A
0B	DUART port B
0C	A31 #1 external buffer
0D	A31 #1 internal context memory (phase A)
0E	A31 #1 internal context memory (phase B)
0F	A31 #1 internal TXVM memory
10	A31 #1 configuration memory
11	A31 #1 external FIFO
12	A31 #2 external buffer
13	A31 #2 internal context memory (phase A)
14	A31 #2 internal context memory (phase B)
15	A31 #2 internal TXVM memory
16	A31 #2 configuration memory

Table 15
Fibre Peripheral Controller selftest HEX codes (Part 2 of 2)

HEX code	Test description
17	A31 #2 external FIFO
18	R72 N-P switching control memory
19	R72 320x8 NIVD buffer
1A	R72 N-P Quiet code register
1B	R72 P-N switching control memory
1C	R72 640-8 XIVD buffer
1D	R72 640-8 XIVD loopback buffer test
1E	R72 P-N Quiet code register
1F	R71 register test
20	R71 continuity test, peripheral side
21	R71 continuity test, network side
22	R71 packet transmission test
23	Interrupt test
24	R71 continuity test, peripheral side DS30X

Table 16
Alphabetical list of MMI commands (Part 1 of 4)

Command	Description
CLOG	Clears the log file and deletes all the messages.
CXSM	For remote floor-standing column. Checks the communication between the Fibre Peripheral Controller and the system monitor in the pedestal. The output is: **Wait...** during the test and after the test it displays: **XSM** responding or **XSM not responding**.
EOIA on/of	Default is off. Monitors EOI laser controller and reports the result: #n= 0 (primary), #n=1 (secondary) EOI #n ALARMS: Transmitter Fail EOI #n ALARMS: Transmitter is OK EOI #n ALARMS: Laser Fail EOI #n ALARMS: Laser is OK EOI #n ALARMS: Transmitter Input Clock Loss EOI #n ALARMS: Transmitter Input Clock is OK EOI #n ALARMS: Laser Degrade EOI #n ALARMS: Laser Degrade is OK EOI #n ALARMS: Laser ShutDown EOI #n ALARMS: Laser ShutDown is OK EOI #n ALARMS: Receiver Fail, alarm= x EOI #n ALARMS: Receiver is OK EOI #n ALARMS: Receiver Optical Input Fail, alarm= x EOI #n ALARMS: Receiver Optical Input is OK EOI #n ALARMS: Low Optical Input Power, alrm= x EOI #n ALARMS: Low Optical Input Power is OK EOI #n ALARMS: High Optical Input Power, alrm= x EOI #n ALARMS: High Optical Input Power is OK
<ESC>L	Changes the MMI port to local or MMI mode. ESC must be the first character in the command and must be preceded with 1.5 seconds of no-input.
<ESC>R	Changes the MMI port to remote or SL-1 mode. ESC must be the first character in the command and must be preceded with 1.5 seconds of no-input.

Table 16
Alphabetical list of MMI commands (Part 2 of 4)

Command	Description
FORC PRI/SEC	Performs forced switch of the active span to PRI=primary or SEC=secondary packlet.
HELP	Displays the list of commands.
IDC M/P/S	Query card ID information where M=main board (default setup), P=primary packlet, and S=secondary packlet
MANS PRI/SEC	Performs manual switch to the primary or secondary link in a redundant link configuration.
MCLR	Clears manual link switching and restores the automatic link backup.
NLOG {n}	Prints the next n messages from a log file starting with the message following the last printed. If **n** is omitted, one message is printed.You can change the last message printed by executing **PLOG** command.
PLOG {n}	Prints **n** messages from the log file starting with the oldest message. If **n** is omitted, one record is printed. If **n** is larger than the file or if **n**=0, the entire file is printed.
QDEF	Query the default mode of the MMI port. The response can be: **Local** or **Remote**
QFIB	Query the status of fibre-optic links. The response format is: **PRIM physical signal direction** **SEC physical signal direction** where **physical** can be: **equip, unequip**, or **faulty signal** can be: **SF** (failed), **SD** (degrade), or **NA** (no alarm) **direction** can be: **incoming, outgoing, both**, or **none**.

Table 16
Alphabetical list of MMI commands (Part 3 of 4)

Command	Description
QVER	Query version of the firmware and loadware.The response is: **Boot: xx Main: yy PSDL: zz** where **xx**= version of the boot firmware in EPROM **yy**= version of the main program, which is the last real download or the factory issue **zz**= version defined by the **SVER** command
QXSM	Query the system monitor port number that can be from 1 to 63.
SCID M/P/S string	Sets card ID of: **M**=main board, **P**=primary packlet, or **S**=secondary packlet. The string is programmed on an EEPROM. A maximum of 32 characters can be contained in the string. A password is required to execute the command. The response to the command can be: **OK** if the command execution is successful or **FAILED** if the execution failed.
SDEF L/R	Sets the default mode to Local (MMI mode) or Remote (SL-1 mode).This command does not affect the current working mode, but it does affect the default mode after the reset or power-up.
STAD d m y h m s	Sets time and date with **day, month, year, hour, minute**, and **second**
STAT	Query card status. The response can be: **Enabled/Disabled PLL: lock/unlock prim/sec** Enabled/Disabled indicates the status of the card. If Enabled, the CPU enabled it; otherwise, the response is Disabled. **PLL: lock/unlock** indicates the status of the PLL on the card. If locked, it indicates whether it is locked on the **primary** or **secondary** link. At the Fibre Superloop Network card an additional response is printed: **n busy** shows the number of time slots busy.

Table 16
Alphabetical list of MMI commands (Part 4 of 4)

Command	Description
SUBM string	Submits a command to the other side of the span where **string** represents the actual command executed by the other side. The response, if any, is printed locally.
SVER version	Sets the PSDL version, which is presented to the CPU. The parameter **version** is a decimal number and it must match the actual version of the non-fibre superloop and peripheral controller card version. This command affects only the cards on which it is executed.
SXSM n	Defines the system monitoring address **n** for a wall-mounted cabinet Fibre Remote IPE. The address is also stored in the Fibre Peripheral Controller card EEPROM. The command is in effect immediately.
TEST {P/S}	Tests the entire card if **P/S** is omitted, tests only the primary packlet if **P** is specified, or tests only the secondary packlet if **S** is specified. To test the entire card, you must first disable the card. To test the packlet the card can be active but the packlet you are testing must be idle. Test results are printed on the MMI terminal. If any of the tests fail, refer to Table 15, "Fibre Peripheral Controller selftest HEX codes," on page 149 for explanation.
TTAD	Query time and date.

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Meridian 1

Fiber Remote IPE

Description, Installation, and Maintenance

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Meridian 1

Carrier Remote IPE

Description, installation, and maintenance

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About this document

Reference list

The following are the references in this section:

- *Meridian 1 installation planning (553-3001-120)*
- *Meridian 1 system engineering (553-3001-151)*
- *Meridian 1 power engineering (553-3001-152)*
- *Meridian 1 system installation procedures (553-3001-210)*
- *X11 features and services (553-3001-306)*
- *X11 input/output guide (553-3001-311)*

This document is a supplement to Meridian 1 NTPs and provides the information specific to system options 21E, 51, 51C, 61, 61C, 71, 81, and 81C as well as NT and XT system implementations of the Carrier Remote IPE feature.

Meridian 1 Carrier Remote IPE system complies with Part 68 of the United States Federal Communication Commission (FCC) rules. For detailed information, refer to *Appendix B: FCC Rules, Part 68* in this document.

It describes the operation of the carrier equipment and provides specific information on how to install and maintain this equipment as an integral part of the PBX systems and system options. Carrier Remote IPE equipment configuration is identical to the equivalent standard equipment in Meridian 1. However, there are some additional carrier specific commands that can be executed using the man machine interface (MMI) terminal to specifically control carrier equipment.

The following describes what you will find in this document:

Product description describes the Carrier Remote IPE functional and physical characteristics, general engineering guidelines, and planning and ordering information.

Installation and configuration steps you through preparing the site, installing carrier interface equipment at the local system site and the Carrier Remote IPE site, and connecting the local and the remote site to the T1 or E1 carrier links.

Acceptance testing describes how to perform some functional tests to verify that the installed Carrier Remote IPE feature is operating correctly.

Maintenance describes how to perform routine administrative and maintenance functions and how to troubleshoot the Carrier Remote IPE equipment and the carrier link connections. It explains how to isolate problems, fix or replace defective equipment, and verify that the equipment is operating correctly after corrections or replacements have been made.

Appendix A lists messages generated by the system CPU and the remote carrier equipment. These messages indicate the status of the equipment and identify a faulty component when problems occur.

Appendix B provides general information about FCC Rules, Part 69 supplied to the user as required by the FCC.

Appendix C provides connection diagrams at the local and remote sites and connector pin assignments for all external connectors that connect carrier links, the TTY terminal, the SDI port, and the external alarms.

This document provides detailed information on how to install, configure, and maintain the carrier equipment. However, it also references various NTPs, which contain additional information that may be required when installing and maintaining the Carrier Remote IPE.

References

The following is a list of documents that are referenced in this document for additional information:

— *Meridian 1 installation planning (553-3001-120)*

— *Meridian 1 system engineering (553-3001-151)*

— *Meridian 1 power engineering (553-3001-152)*

— *Meridian 1 system installation procedures (553-3001-210)*

— *X11 features and services (553-3001-306)*

— *X11 input/output guide (553-3001-311)*

Carrier Remote IPE product description

Reference list

The following are the references in this section:

- *Meridian 1 installation planning (553-3001-120)*
- *Meridian 1 system engineering (553-3001-151)*
- *Meridian 1 system installation procedures (553-3001-210)*

This chapter describes Carrier Remote Intelligent Peripheral Equipment (IPE), its architecture, and hardware options.

System overview

Meridian 1 system options 21E, 51, 51C, 61, 61C, 71, 81, and 81C as well as NT and XT systems are private branch exchange (PBX) systems that support Carrier Remote IPE service.

In addition to supporting local subscribers, each system can be configured as a distributed system that supports remote subscribers using Carrier Remote IPE modules in a column or Carrier Remote IPE cabinets. They are connected to the PBX at long distances using T1 or E1 carrier facilities.

To support the Carrier Remote IPE, the system must be running on X11 Release 21 or later and must be equipped with the Carrier Remote IPE software package REM_IPE 286.

Subscriber loops at the local system site (at the PBX) are the same as at the Carrier Remote IPE modules or Carrier Remote IPE cabinets. The subscriber functions and features at the local system site are also the same as at the Remote IPE site.

This document focuses on the equipment within the PBX and the Remote IPE that is specifically designed to provide T1 or E1 carrier links between the network functions in the system and the peripheral controller functions in the Remote IPE.

System description

The Carrier Remote IPE provides PBX functionality by installing only IPE modules and IPE cards at a distant site. The Remote IPE shares the system common and network equipment to provide the same functions and features to remote subscribers that are available to local system subscribers.

To successfully implement Carrier Remote IPE functions, you must understand:

— Carrier Remote IPE physical architecture

— Carrier Remote IPE functional architecture

Carrier Remote IPE physical architecture

To configure a system with Carrier Remote IPE, you can install an IPE column or Carrier Remote IPE cabinet at a remote site and connect it, using T1 or E1 carrier links or direct copper connection (if the distance is less or equal to 200 meters or 655 feet), to an existing system. Tables 1 and 2 list specific equipment required to support the Carrier Remote IPE at the local site and at the remote site.

> ***Note:*** The cards and the cable assemblies listed in Table 1, Table 2 and Table 3 are common to T1 and E1 carrier systems, however, if E1 carrier links are terminated with BNC connectors, an external adapter cable (not supplied with the equipment) is used to connect each 8-pin modular (RJ48-type) jack on the system I/O panel assembly to the BNC connectors on each E1 carrier link.

Table 1 lists all the hardware components required at the local system site to support Carrier Remote IPE service. Only one type of carrier can be supported by each Local Carrier Interface card. The carrier type is switch-selected on the Local Carrier Interface card. Appendix C provides connection diagrams and connector pin assignments for all external connectors on the I/O panel assemblies.

Table 1
Local site carrier hardware list (Part 1 of 2)

Component	Description
NT7R51 Local Carrier Interface card	Local Carrier Interface card installed in a network card slot.
NT7R66AA SDI Cable Kit	This cable kit provides a DB-9 male to DB-25 male 10-foot cable and a DB-25F/DB-25F adapter. To connect the standard SDI card to the DB-9 female P2 connector of the NT7R67DA cable at the local site, you would use the entire kit except for the DB-25F/DB-25F adapter, which is used with the SDI Paddleboard.
NT7R66BA MMI Cable	This is a DB-9 female to DB-25 male 32-foot cable. Connect the MMI terminal to the DB-9 male P3 connector of the NT7R67DA cable at the local site and directly to the MMI port of the Carrier Remote IPE site.
NT7R67BA Local Carrier/Monitor Cable Assy	This cable assembly connects the Local Carrier Interface to the network I/O panel. It consists of the NT7R67HA cable, the NT7R57AA Carrier Panel assembly, and the NT7R58AA Maintenance Panel assembly. The P1 DB-25 male connector plugs into the faceplate, the P2 DB-15HD male connector plugs into the NT7R58AA Maintenance Panel assembly, which provides two 6-pin modular system monitor jacks and one DB-9 female MMI maintenance connector. The P3 DB-15HD female connector plugs into the NT7R57AA Carrier Panel assembly, which provides three 8-pin modular carrier jacks. Refer to Appendix C, Figure 27, Figure 28, and Figure 31.
NT7R67CA Local Daisy-chain Cable Assy	This cable provides P1 DB-9 male connector that plugs into the faceplate and P2 DB-9 male connector that plugs into the NT7R58AA Maintenance Panel assembly. This cable is used with multiple Local Carrier Interface cards in a daisy-chain configuration or in a single Local Carrier Interface configuration to connect the MMI terminal. Refer to Appendix C, Figure 27, Figure 28, and Figure 31.
NT7R67DA Local External Maint. Cable Assy	Cable with the P1 DB-9 male connector that plugs into the NT7R58AA Maintenance Panel DB-9 female connector, the P3 DB-9 male connector that plugs into the MMI terminal or modem cable (or the preceding Local Carrier Interface connection in a daisy-chain), and the P2 DB-9 female connector that plugs into the SDI port (or the following Local Carrier Interface connection in the daisy-chain). Refer to Appendix C, Figure 27 and Figure 28
NT7R67EA Coaxial Interface Adapter Cable	Cable with one 8-pin modular plug that plugs into the NT7R57AA Carrier Panel Assy 8-pin modular jack and two BNC connectors that plug into the carrier link BNC connectors.

Table 1
Local site carrier hardware list (Part 2 of 2)

Component	Description
NT7R69AA Extension Local Carrier Cable Assy	Cable extends the NT7R67BA cable assembly. It plugs into the DB-25 connector on the Local Carrier Interface card faceplate and into the DB-25 P1 connector of the NT7R67BA cable assembly.(Used for NT and XT (QCA55/QCA58) type cabinet systems. This assembly also includes the P0846521 Connector Adapter Plate.
NT7R69BA Extension Local Maint. Cable Assy	Cable extends the NT7R67CA cable assembly. It plugs into the DB-9 connector on the Local Carrier Interface card faceplate and the P1 DB-9 connector of NT7R67CA cable assembly. Used for NT and XT (QCA55/QCA58) type cabinet systems. This assembly also includes the P0846521 Connector Adapter Plate.
NT7R87AA T1 CSU Cable Kit	This cable kit consists of a DB-15M/RJ48 adapters and a 9.75 m 32-foot RJ48 to RJ48 cable. The appropriate adapter is used to connect to a CSU and the cable is used to connect the adapter to the NT7R57AA Carrier Panel Assy RJ48 connector.
NT8D46AL System Monitor Serial Link Cable	Connects the 6-pin modular jack J5 on the NT7R58AA Maintenance Panel assembly to the system monitor jack J6 in the pedestal.
NT8D93AJ XSDI I/O to DTE or DCE Cable	This is a DB-9 male to DB-25 male 4.8 m 16-foot cable used to connect the SDI Paddleboard to the NT7R67DA Local External Maintenance Cable P2 DB-9 female connector. The entire NT7R66AA SDI Cable Kit must also be used.
NT5D40AA Hybrid kit	Used to replace BTUs in some network modules. The replacement is necessary to be able to install the Local Carrier Interface card in that slot.

Table 2 lists the hardware required for the Carrier Remote IPE UEM column at the remote site. Appendix C provides external connectors pin assignments.

Table 2
Remote Carrier IPE module hardware list (Part 1 of 2)

Component	Description
NT7R52 Remote Carrier Interface card	Remote Carrier Interface card (installed in the Remote IPE module or the Remote IPE cabinet).
NT8D37 IPE Module	Carrier Remote IPE module.
NT7R66BA MMI Cable	This is a 32-foot DB-9 female to DB-25 male cable. Connect the MMI terminal to the DB-9 male MMI connector on the NT7R61AA Maintenance Panel Assy.
NT7R68AA Remote Carrier/Alarm Cable Assy	This cable assembly connects the Remote Carrier Interface to the I/O panel at the rear of the IPE module for T1/E1 and auxiliary customer alarm connections. Consists of the NT7R68HA cable with 24-pin block P1 connector that plugs into the SL1 backplane connector, the NT7R59AA Carrier Panel assembly already connected to the cable with P2 DB-15HD male connector, and the NT7R60AA Carrier/ Alarm Panel assembly connected to the cable with P3 DB-9 female connector. The NT7R59AA Carrier Panel assembly provides two 8-pin modular carrier jacks and the NT7R60AA Carrier/Alarm Panel assembly provides one 8-pin modular carrier jack and one DB-15 female alarm connector. Refer to Appendix C, Figure 29.
NT7R68BA Remote Maintenance Cable Assy	This cable assembly connects the Remote Carrier Interface to the I/O panel at the rear of the IPE module for system monitor and MMI connections. Consists of the NT7R68GA cable with 24-pin block P1 connector that plugs into the SL1 connector on the backplane, the NT7R61AA Maintenance Panel assembly already connected to the cable with P2 DB-15 male cable connector. The NT7R61AA Maintenance Panel assembly provides one 6-pin modular jack for system monitor and one DB-9 male MMI port connector. Refer to Appendix C, Figure 29.
NT7R67EA Coaxial Interface Adapter Cable	Cable with one 8-pin modular plug that plugs into the NT7R68AA Remote Carrier/Alarm Panel Assy 8-pin modular jack and two BNC connectors that plug into the carrier link BNC connectors.

Table 2
Remote Carrier IPE module hardware list (Part 2 of 2)

Component	Description
NT7R86AA Auxiliary Alarm Cable Assy	Connects auxiliary alarms, such as customer external alarms, to the DB-15HD female Alarm connector on the NT7R60AA Carrier/Alarm Panel. The cable is 9.75 m 32 feet long.
NT7R87AA T1 CSU Cable Kit	This cable kit consists of a DB-15M/RJ48 adapters and a 9.75 m 32-foot RJ48 to RJ48 cable. The appropriate adapter is used to connect to a CSU and the cable is used to connect the adapter to the NT7R59AA Carrier Panel Assy and the NT7R60AA Carrier/Alarm Panel Assy RJ48 connector.
NT8D46AL System Monitor Serial Link Cable	Connects the 6-pin modular jack J5 on the NT7R61AA Maintenance Panel assembly to the J6 system monitor jack in the pedestal.

Table 3 lists the Carrier Remote IPE cabinet equipment. Appendix C provides external connectors pin assignments.

Table 3
Carrier Remote IPE wall-mounted cabinet hardware list (Part 1 of 3)

Component	Description
NT7R52 Remote Carrier Interface card	Remote Carrier Interface card (installed in the Remote IPE module or the Remote IPE cabinet).
NTIP70 Main Cabinet Assy	Main wall-mounted (or pedestal mounted) Carrier Remote IPE cabinet. The NT1P70 consists of the NT1P60 Main Cabinet and mounting hardware.
NTBK70 Expansion Cabinet	Expansion Carrier Remote IPE cabinet. Expands the capacity by six IPE cards. Requires the NTAK1204 Inter-Cabinet cable to connect to the main cabinet.
NTAK27 Pedestal for the Cabinet (optional)	This pedestal allows the Carrier Remote IPE cabinets to be floor-mounted.
NT7R66BA MMI Cable	This is a 9.75 m 32-foot DB-9 female to DB-25 male cable. Connect the MMI terminal to the DB-9 male MMI connector on the NT7R61AA Maintenance Panel Assy.
NT7R67EA Coaxial Interface Adapter Cable	Cable with one 8-pin modular plug that plugs into the NT7R68CA Remote Carrier/Alarm Panel Assy 8-pin modular jack and two BNC connectors that plug into the carrier link BNC connectors.

Table 3
Carrier Remote IPE wall-mounted cabinet hardware list (Part 2 of 3)

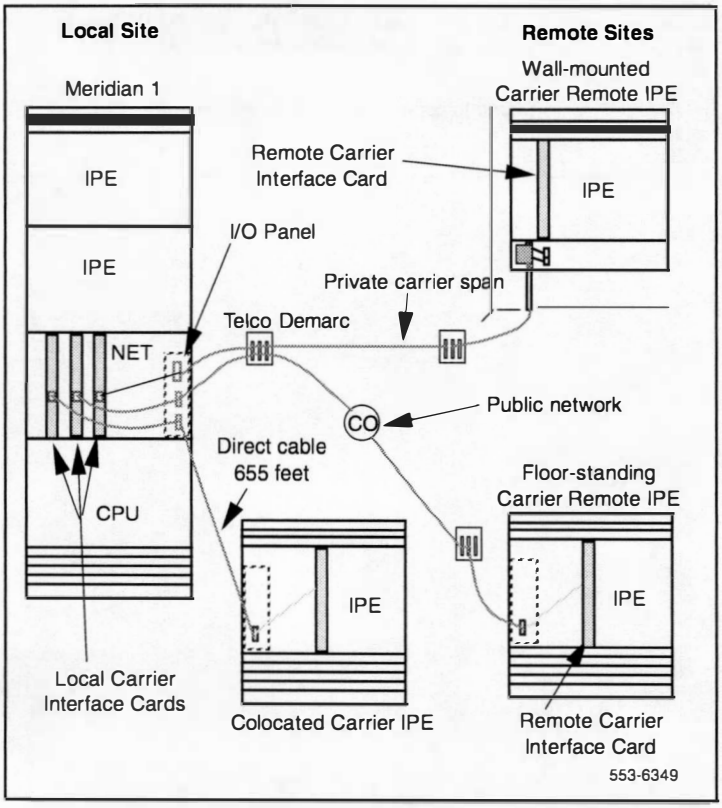
Component	Description
NT7D68DA Remote Maintenance Cable Assy to Cabinet	This cable assembly connects the Remote Carrier Interface to the I/O bracket on the wall-mount IPE cabinet for system monitor and MMI connections. Consists of the NT7R68NA cable that connects with P1 DB-9 male connector to the TTY connector on the backplane and is already connected to the NT7R61AA Maintenance Panel assembly with the DB-15 male P2 cable connector. The DB-15 female P3 cable connector must be plugged into the NT7R60AA Carrier/Alarm Panel assembly connector during cable installation. The NT7R61AA Maintenance Panel assembly provides a DB-9 male MMI port connector. Refer to Appendix C, Figure 30.
NT7R86AA Auxiliary Alarm Cable Assy	Connects auxiliary alarms, such as customer external alarms, to the DB-15HD female Alarm connector on the NT7R60AA Carrier/Alarm Panel. The cable is 9.75 m 32 feet long.
NT7R87AA T1 CSU Cable Kit	This cable kit consists of a DB-15M/RJ48 adapters and a9.75 m 32-foot RJ48 to RJ48 cable. The appropriate adapter is used to connect to a CSU and the cable is used to connect the adapter to the NT7R59AA Carrier Panel Assy and the NT7R60AA Carrier/Alarm Panel Assy RJ48 connector.
NT7R94AA Remote Cabinet Cable Assy	This Remote Cabinet Cable Assembly consists of the NT7R68CA Remote Carrier/Alarm Cable Assy, the NT7R68DA Remote Maintenance Cable Assy, and the NT7R62AA Bracket. All components are preinstalled in the factory.
NT7D68CA Remote Carrier/Alarm Cable Assy to Cabinet	This cable assembly connects the Remote Carrier Interface to the I/O bracket of the wall-mount IPE cabinet for T1/E1 and auxiliary customer alarm connections. It consists of the NT7R68LA cable that connects with DB-15 male P1 to the Auxiliary Connector on the backplane, the NT7R59AA Carrier Panel assembly that connects to P2 DB-15 female cable connector, and the NT7R60AA Carrier/Alarm Panel assembly that connects to P3 DB-9 female cable connector. The NT7R59AA Carrier Panel (installed in slot 1 of the bracket) provides two 8-pin modular carrier jacks and the NT7R60AA Carrier/Alarm Panel (installed in slot 2 of the bracket) provides one 8-pin modular jack and one DB-15 female alarm connector. The two panels are already connected to the NT7R68LA cable. Refer to Appendix C, Figure 30.
NT7D68DA Remote Maintenance Cable Assy to Cabinet	This cable assembly connects the Remote Carrier Interface to the I/O bracket on the wall-mount IPE cabinet for system monitor and MMI connections. Consists of the NT7R68NA cable that connects with P1 DB-9 male connector to the TTY connector on the backplane and is already connected to the NT7R61AA Maintenance Panel assembly with the DB-15 male P2 cable connector. The DB-15 female P3 cable connector must be plugged into the NT7R60AA Carrier/Alarm Panel assembly connector during cable installation. The NT7R61AA Maintenance Panel assembly provides a DB-9 male MMI port connector. Refer to Appendix C, Figure 30.

Table 3
Carrier Remote IPE wall-mounted cabinet hardware list (Part 3 of 3)

Component	Description
NTAK04 AC/DC Power Supply for Cabinet	Used when the Carrier Remote IPE cabinet is AC-powered by the commercial power source or UPS.
NTAK05 DC Power Supply for Cabinet	Used when the Carrier Remote IPE cabinet is DC-powered by a - 52VDC power source.
NTAK410 Power Cable for DC Power Supply	Used to connect the cabinet to a reserve battery power supply or to a DC power source through the NTAK28 Junction Box.
NTAK1204 Inter-cabinet Cable	Used to connect the main to the expansion Carrier Remote IPE cabinet.

Figure 1 illustrates Meridian 1 and Remote IPE equipment linked with T1 or E1 carriers over the private network, the public network, and for distances of 655 feet (200 m) or less direct copper cable connection to a collocated Carrier IPE column. The T1 and normally E1 carrier links use 120-ohm twisted pair wires. However, if the E1 carrier links use coaxial cable, 75-ohm impedance must be selected using SW1, SW2, SW5, and SW8 on the Local and Remote Carrier Interface cards (refer to Figure 9 and Figure 15).

Figure 1
Meridian 1 to Remote IPE links



The only equipment specifically designed to support this configuration are the types of cards, cables, and cabinets listed previously in Tables 1 and 2. All the other equipment is standard Meridian 1 hardware.

At the local site, there are two cables that plug into the Local Carrier Interface card faceplate connectors. At the other end, the cable connectors connect to the I/O panel connectors at the rear of the Meridian 1 network module. At the remote site, two cables that plug into the backplane connectors behind the Remote Carrier Interface card contain connectors that are also plugged into the I/O panel connectors at the rear of the Carrier Remote IPE module.

All systems use the same carrier hardware. The cable routing and the location of the I/O panel assemblies is different.

For the Carrier Remote IPE cabinet, two cables connect P2 and P3 backplane connectors to the I/O panel connectors installed on a bracket at the lower left-hand side of the cabinet backplane as shown in Figure 3.

Subscriber loops at the Remote IPE are connected to 50-pin connectors on the I/O panel at the rear of the module or at the bottom front of the cabinet as in standard hardware. For more details about subscriber connections to Meridian 1 and the Remote IPE, refer to *Meridian 1 system installation procedures (553-3001-210).*

You can select one of two options for the Remote IPE enclosure:

— Carrier Remote IPE column

— Carrier Remote IPE cabinet

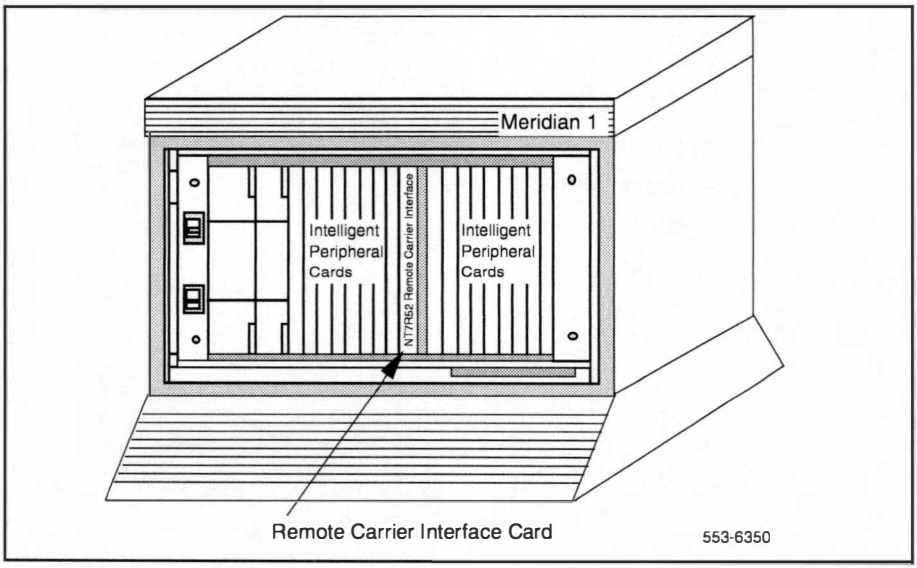
Carrier Remote IPE column

Floor-standing Carrier Remote IPE column includes a pedestal, one or more standard NT8D37 IPE Modules, and a top cap. The IPE module houses a maximum of 16 line cards and a Remote Carrier Interface card. Each Remote Carrier Interface card supports IPE cards in only one IPE module. Therefore, each IPE module requires a Remote Carrier Interface card and one to three T1 or E1 carrier links.

The T1 or E1 carrier link is connected to the Remote Carrier Interface card through the carrier connectors located on the I/O panel at the rear of the IPE module. A cable connects the Remote Carrier Interface card through the backplane to the I/O panel at the rear of the IPE module to establish a connection to the carrier link.

Figure 2 illustrates the front view of the Carrier Remote IPE column with the Remote Carrier Interface card and the IPE cards already installed.

Figure 2
Carrier Remote IPE column



Carrier Remote IPE cabinet

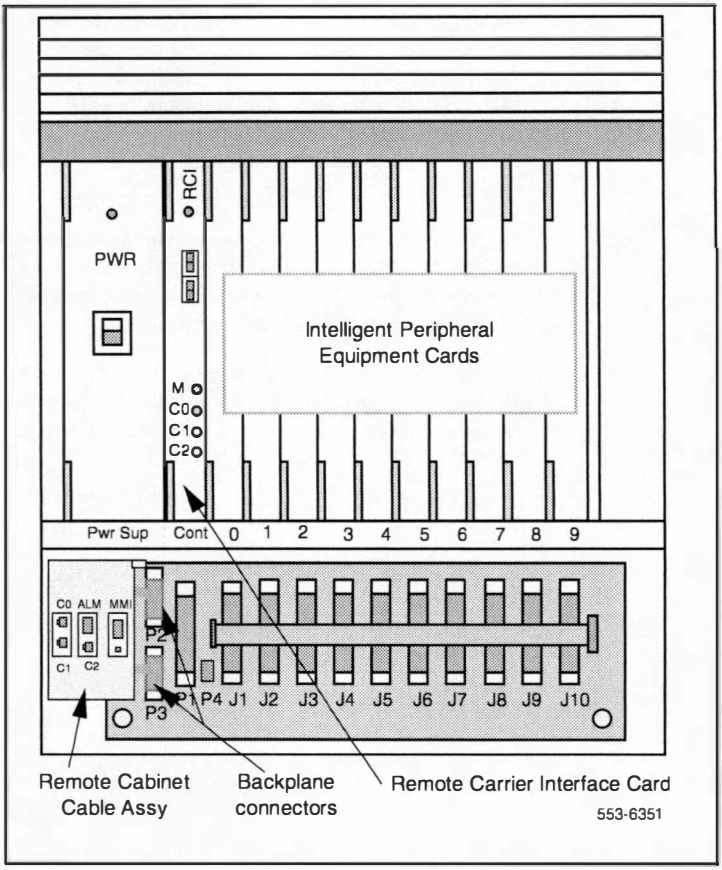
Each Remote Carrier Interface card supports up to 16 IPE cards. The NT1P70/NT1P60 main Carrier Remote IPE cabinet houses an NT7R52 Remote Carrier Interface card and up to 10 IPE cards. This cabinet is the same as used in the Fiber Remote Carrier IPE application. The cabinet is then modified for the Carrier Remote IPE application by simply replacing the existing I/O bracket with NT7R94AA Remote Cabinet Cable Assembly. If additional IPE cards are required, you must use the NTBK70 expansion cabinet, which can house up to six additional cards in card slots 10 through 15. Card slots 16 through 19 in the expansion cabinet are not configurable and must not be used. The main and the expansion cabinets are interconnected by a cable that plugs into the P1 connector located in the lower left-hand corner of each cabinet's backplane.

The T1 or E1 carrier link is connected to the Remote Carrier Interface card through P2 and P3 backplane connectors. These backplane connectors are connected to the I/O panel, which is mounted on a bracket at the lower left-hand corner of the cabinet backplane.

Carrier Remote IPE main and expansion cabinets can be AC or DC powered. The power source is directly connected to the shelf power supply for the AC-powered system and to the shelf power converter for the DC-powered system.

Figure 3 illustrates the front view of the NT1P70/NT1P60 Carrier Remote IPE cabinet. It also shows the location of the NT7R52 Remote Carrier Interface card.

Figure 3
Carrier Remote IPE cabinet



Carrier Remote IPE functional architecture

Carrier Remote IPE functions are controlled by the system CPU and the firmware in the Local Carrier Interface and Remote Carrier Interface cards. The CPU uses software instructions to execute call processing, administration, and diagnostic functions. These functions can be divided into three basic categories:

— CPU functions

— Network functions

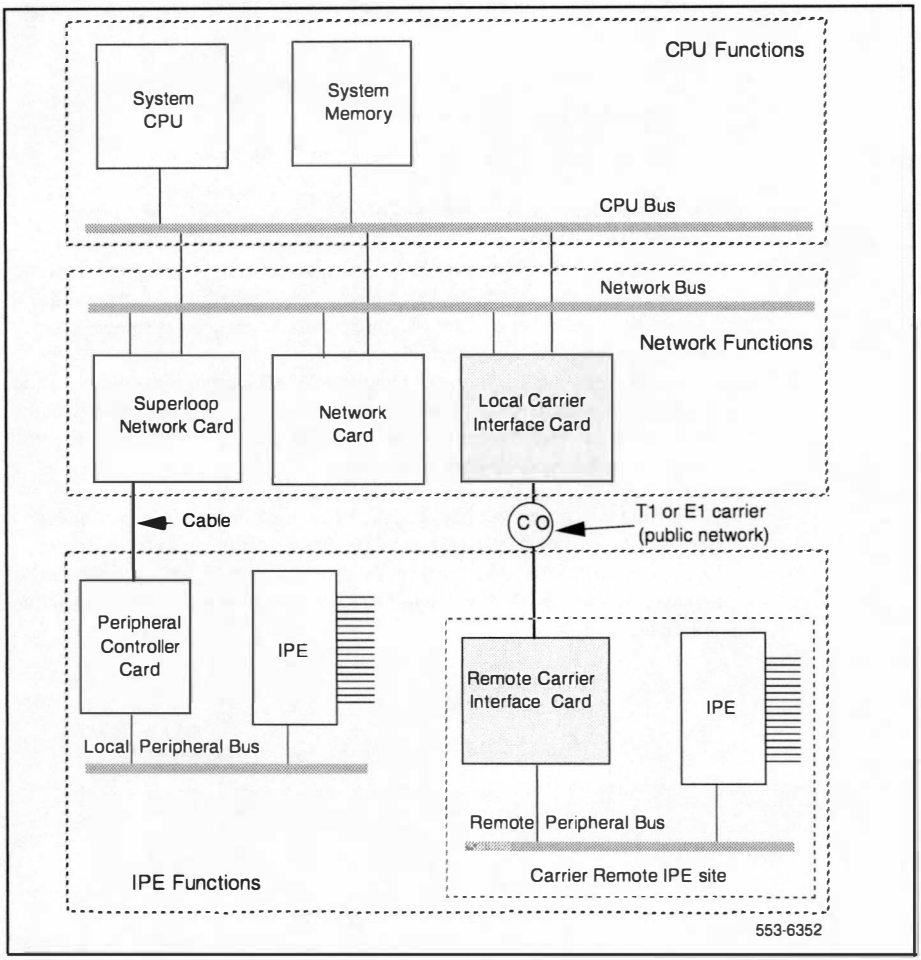
— IPE functions

The communication and signaling between the system and the Carrier Remote IPE is performed over the first three timeslots of each T1 or E1 carrier link including the spare link. The other timeslots of each carrier link are used to transmit voice and data information originating and terminating at Remote IPE subscriber stations. All three carriers transmit the same messages and signaling across the carrier link; however, the system selects only one carrier for signaling and message handling. Which carrier it uses depends on the past carrier link events, or when one carrier has a lower error rate than the other carriers in the link, the system selects the carrier with the lowest error rate for signaling and message extraction.

A T1 or an El carrier link between the Local Carrier Interface card and a Remote Carrier Interface card can be configured with one to three carrier links, where all three links carry traffic or where one of the two links can be assigned as a spare link that is standing by to take over traffic when an active link fails.

Figure 4 illustrates the system functional architecture on a broad block diagram level to show the three basic types of functions.

Figure 4
System functional architecture



To maintain optimum service during carrier failure and recovery, the system automatically enables the exact number of timeslots required for the number of active physical links between the system and the Carrier Remote IPE. All the other timeslots provided by the superloop are inhibited to prevent system assignment of too many timeslots for the number of active carriers in the link. If the number of active links changes due to failure of one or more links, or if reactivation of a previously faulty link occurs, the system dynamically adjusts the number of available timeslots to support currently active carriers in the link.

CPU functions

CPU functions are executed by the system software in the CPU module or shelf. The CPU responds to the interrupt requests from the network equipment and the IPE, and performs the following functions:

— controls originating calls, terminating calls, and feature operation for switched voice and data calls

— prevents establishing new data calls if CALS= 2

— executes system administration and configuration functions

— coordinates system diagnostic activities

— controls system utility functions such as software loading, initialization, data dumping, traffic logging, and system auditing

Even though the Remote IPE is removed from the system, the system CPU controls its functions the same way it controls functions of telephones and stations connected to line cards in local IPE modules.

Network functions

Network switching functions are executed by the equipment housed in the system network card slots. The Local Carrier Interface card is installed in a network card slot and, through its T1 or E1 carrier links, connects to the Remote Carrier Interface card installed in the Carrier Remote IPE module or cabinet.

The system provides these network functions:

— performs hardware initialization and self-test upon power up

— establishes call connections between stations connected to Remote IPE line cards and stations local to the system or to trunks for long distance trunk calls over public or private networks

— communicates switching, peripheral signaling, and maintenance information to and from the CPU, the Local Carrier Interface card MPU, and the Remote Carrier Interface MPU

— manages timeslot assignment for active carrier links and timeslot blocking of the remaining timeslots on the superloop that are not required to support the existing active carrier links

— monitors T1 or E1 carrier link integrity and transmission quality and provides automatic link switching from the failed primary link to the spare link, if so configured

— optionally, if PRI/DTI/BRI cards are not installed in the system, provides clock to the Clock Controller card to synchronize the network bus to the T1 or E1 carrier clock

— provides local and remote loopback testing and fault isolation functions

IPE functions

Intelligent peripheral equipment functions are performed by the Remote Carrier Interface card and line cards in the Carrier Remote IPE module or Carrier Remote IPE cabinet.

The system provides these IPE functions:

— performs hardware initialization and self-test upon Remote Carrier Interface card power-up

— assigns timeslots to line cards to establish call connections

— communicates with the Local Carrier Interface card MPU to provide Remote IPE configuration and maintenance functions

— monitors the link integrity and transmission quality and notifies the Local Carrier Interface card, which provides automatic carrier switching from the failed primary carrier to the spare carrier 2 if the link is set up with the spare carrier option

— provides Card-LAN management by polling IPE cards and reporting their status

— controls local station ringing functions

— provides a serial port for local configuration and maintenance functions

— provides local and remote loopback testing and fault isolation functions

Functional description

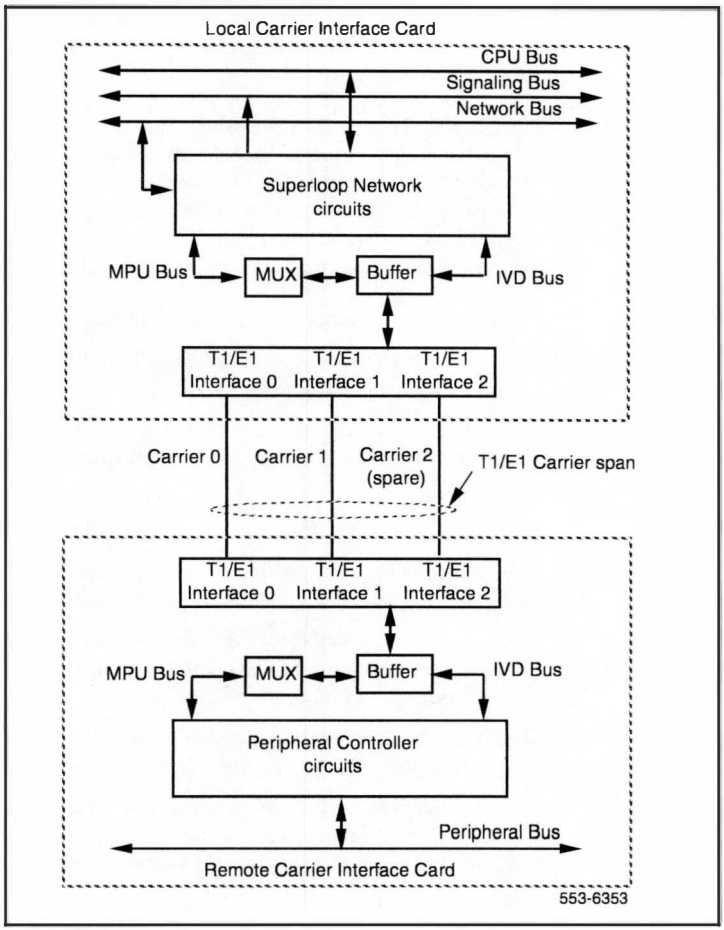
The system is controlled by the CPU. The CPU performs read/write functions on the network control and status registers and communicates with the network equipment over the CPU bus. Through these messages, the CPU monitors the system status, provides call connection sequences, monitors traffic activities, downloads application software and configuration data, and performs system administration and diagnostics.

Carrier Remote IPE utilizes T1 or E1 carrier links to provide the same subscriber functionality at the remote site as at the Meridian 1 local site.

Figure 5 illustrates the Carrier Remote architecture. It shows the Local Carrier Interface card, the Remote Carrier Interface card, and the internal bus structure that connects them to other system components.

Figure 5 shows the carrier interface circuits to provide an understanding of the internal system communication and call processing activities through the T1 or E1 carrier link.

Figure 5
Meridian 1 Carrier Remote architecture



Local Carrier Interface card

The Local Carrier Interface card is a microprocessor-controlled network interface between the system CPU and the remote peripheral equipment. To communicate with the CPU, the system uses the network, the signaling, and the CPU buses located in the system network module.

The Local Carrier Interface card occupies one network card slot and supports a maximum of 120 timeslots for voice and data transmission with the Remote Carrier Interface card.

A subset of these available timeslots are dynamically activated depending on T1 or E1 carrier and the number of active links in the carrier link. A maximum of 63 timeslots are used for a T1 link with three active carriers or a maximum of 81 timeslots are used for an E1 link with three active carriers. Timeslots that are not associated with physical T1 or E1 carriers are disabled. This prevents assigning carrier-inaccessible timeslots to the peripheral equipment.

The main Local Carrier Interface card provides the following functions:

— provides from one to three dedicated T1 or E1 carrier links to connect the Carrier Remote IPE to the system

— assigns specific network timeslots to each T1 or E1 carrier link to communicate with the peripheral equipment

— synchronizes the system Clock Controller with the clock signal recover from the carrier link

— manages the carrier administration, maintenance, performance monitoring, and automatic carrier reconfiguration

— provides a miscellaneous timeslot (timeslot 2) in each T1 or E1 link to support multiplexed Card-LAN, SDI transport, system monitor, and carrier maintenance information

— supports two signaling timeslots (timeslots 0 and 1) in each carrier link to transmit signaling information across the link

— provides elastic store (two frames long) to compensate for delays between different carriers in the link and allow for proper alignment of all the timeslots on the internal voice/data (IVD) bus

— provides an interface for system power and alarm monitoring

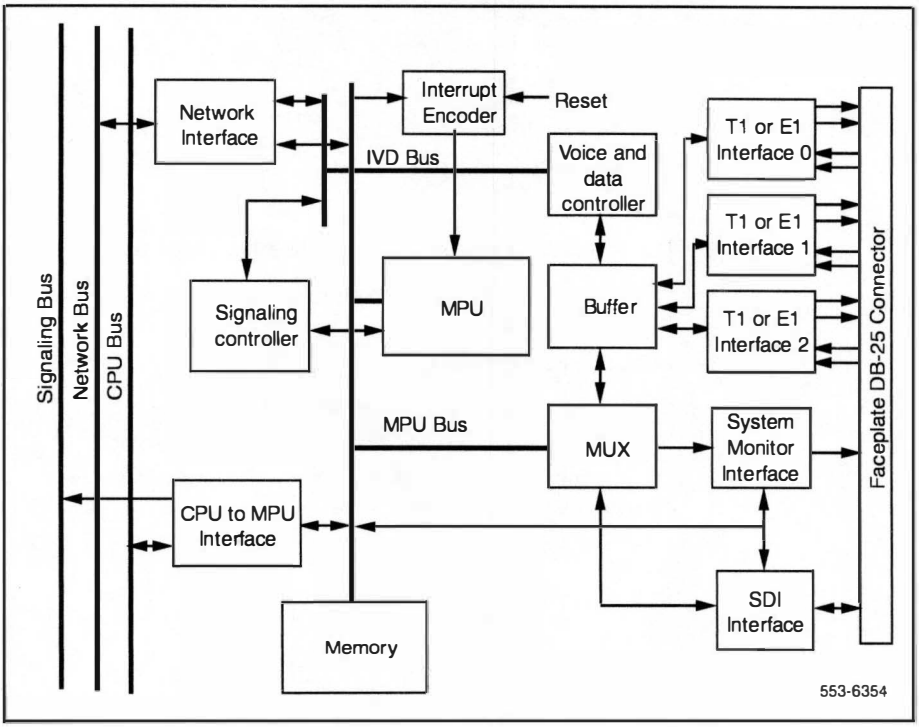
— provides an interface for a maintenance port

— provides continuity test pattern generation and detection for loopback testing

— performs diagnostic self-tests during power-up and also when requested by the CPU

Figure 6 shows the Local Carrier Interface card block diagram illustrating major functional blocks.

Figure 6
Local Carrier Interface card functional block diagram



Micro Processing Unit (MPU)

The MPU coordinates and controls data transfer and addressing of the peripheral devices and communicates with the system CPU using a message channel on the CPU bus. The tasks that the MPU performs depend on the interrupts it receives. These interrupts are prioritized by the importance of the tasks they control.

The MPU is highly integrated and provides most of the decision making logic on the chip. Functions of the MPU include controllers, timers, control and arbitration logic, address decoding, dual-port RAM and independent direct memory access, input/output ports, and independent full-duplex serial communication channels that support various protocols.

The MPU can be reset by:

— powering up the Local Carrier Interface card

— the watchdog timer

— the ENB/DIS switch

— the system CPU command

Memory

The Local Carrier Interface memory stores the following programs and data:

— Boot code, self-test code, and operating firmware are stored in the EPROM.

— Data is stored in the RAM.

— Code that is downloaded by the Meridian 1 CPU to the Local Carrier Interface card MPU and main function code are stored in the RAM.

— Data containing the Local Carrier Interface card identification and version is stored in the EEPROM.

CPU to MPU bus interface

Information exchange between the system CPU and the Local Carrier Interface MPU is performed with packetized messages transmitted over the CPU bus.

This interface uses shared static random access memory (SRAM) as a communication exchange point between the CPU and the MPU. Both the CPU and the MPU can access this memory over the transmit and receive channels on the CPU bus.

Network bus interface

The network bus interface performs two major functions:

— converts bit interleaved serial data received from the network bus into byte interleaved data for transmission over the timeslots used by the IVD bus

— accepts byte interleaved data transmitted from the IVD bus and converts it into a bit interleaved data stream for transmission over the network bus

Carrier interface

Each Local Carrier Interface card has three T1/E1 interfaces to provide two primary links and a spare, or three primary T1 or E1 carrier links. Each T1 or E1 carrier interface is switch-selectable to a 1.5 Mbps T1 or a 2 Mbps E1 point-to-point transmission facility. A carrier interface card does not support a combination of T1 and E1 carrier links on a carrier link; it supports only T1 or E1 carriers.

The T1 or E1 carrier interface performs the following functions:

— Connects the system to Remote IPE using one to three T1 or E1 carrier links.

— Provides a communication channel between the Local Carrier Interface card MPU and the Remote Carrier Interface card MPU over timeslot 2 of each carrier. It also multiplexes the system monitor, Card-LAN, and the SDI port information and transmits it over timeslot 2 across the link.

— Transmits signaling information across the carrier link by using timeslots 0 and 1 of each carrier.

— Provides a distance-selectable switch that selects the distance from the Local Carrier Interface card to the first signal regenerator such as a repeater, a CSU, or an LTU in the carrier link to be from 0 to 200 m (0 to 655 ft).

— Uses elastic store buffers to store two frames of carrier data stream to compensate for possible information propagation delays between different carrier timeslots in the link. This allows for proper timeslot alignment of all the carriers on the IVD bus.

— Identifies the card and firmware versions, which are stored in the EEPROM.

— Monitors transmission quality of the link. If the transmission is degraded or fails, the Local Carrier Interface card automatically transfers to the spare link, if equipped.

Remote Carrier Interface card

The Remote Carrier Interface card is a microprocessor-controlled peripheral interface between the Local Carrier Interface card and the Remote IPE line cards. To communicate with the Local Carrier Interface card, the Remote Carrier Interface card uses one to three T1 or E1 carrier links. To communicate with the peripheral equipment, the Remote Carrier Interface uses 16 full-duplex serial loops, one for each line card in the Carrier Remote IPE module or Carrier Remote IPE cabinets.

The Remote Carrier Interface card occupies one controller card slot in the IPE module. However, the adjacent card slot is not the full width and must remain empty. This narrower card slot is due to the fact that a standard peripheral controller card occupies two card slots in the IPE module, and the Remote Carrier Interface card that plugs into the same backplane connector, occupies only one card slot. The dummy faceplate can be used in the empty card slot in the Carrier Remote IPE module for aesthetic reasons but is not needed in the Carrier Remote IPE cabinet.

The main Remote Carrier Interface card provides the following functions:

— Provides one to three T1 or E1 carrier links to connect the Carrier Remote IPE to the system.

— Assigns timeslots on the T1 or E1 carrier link to timeslots of the 16 full-duplex serial loops assigned to line cards in the IPE module.

— Provides a Remote Carrier Interface Microprocessor (RCIM) to execute administrative and MMI port commands and manage the carrier administration, maintenance, performance monitoring, and automatic carrier reconfiguration.

— Transmits signaling information across the carrier link by using timeslots 0 and 1 of each carrier.

— Provides a communication channel between the Local Carrier Interface card MPU and the Remote Carrier Interface card MPU over timeslot 2 of each carrier. It also multiplexes the system monitor, Card-LAN, and the MMI port information and transmits it over timeslot 2 across the carrier link.

— Uses elastic store buffers to store two frames of carrier data stream to compensate for possible information propagation delays between different carriers in the link. This allows for proper timeslot alignment of all carriers on the IVD bus.

— Provides a distance-selectable DIP switch that selects the distance from the Remote Carrier Interface card to the first signal regenerator such as a repeater, a CSU, or an LTU in the carrier link to be from 0 to 200 m (0 to 655 ft).

— Converts SSD-type signaling format received from the Local Carrier Interface card to the signaling format for digital telephone sets, and from the digital telephone sets format to SSD-type format.

— Polls telephone sets to determine the line type and its signaling protocol and transmits this information to the Local Carrier Interface card.

— Provides an interface for MMI administration and maintenance ports.

— Provides continuity test, line card polling, card enabling/disabling, and loopback testing functions.

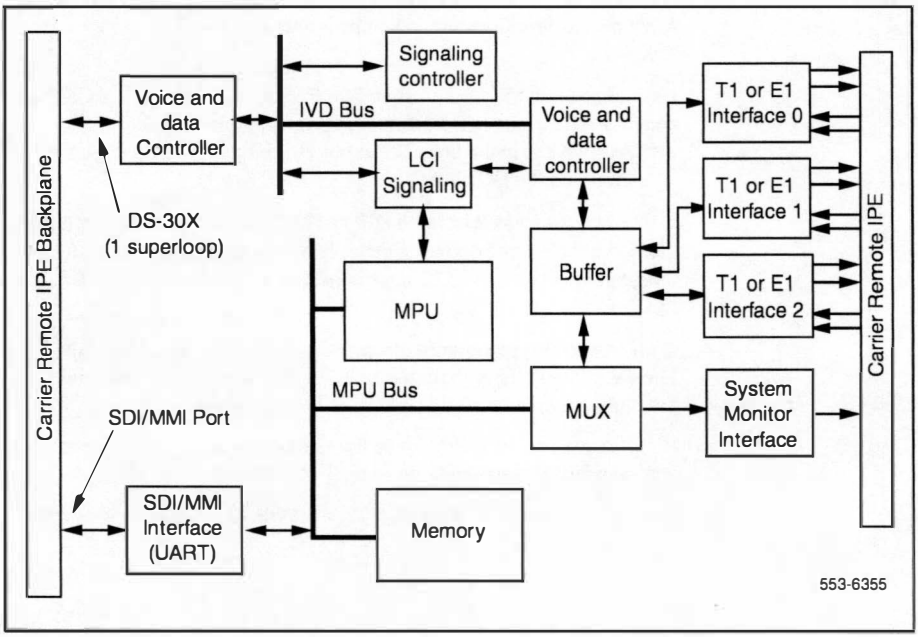
— Accesses up to three external alarm inputs, which are multiplexed with maintenance and diagnostic messages sent to the Local Carrier Interface card MPU.

— Provides an interface for system power and alarm monitoring.

— Performs diagnostic self-tests during power-up and when requested by the CPU.

Figure 7 shows the Remote Carrier Interface card block diagram illustrating major functional blocks. Functions of these blocks are described in the following sections.

Figure 7
Remote Carrier Interface card functional block diagram



Micro Processing Unit (MPU)

The MPU coordinates and controls data transfer and addressing of the peripheral devices and communicates with the Local Carrier Interface card using serial communication channels over the carrier timeslot 2. Tasks that the MPU performs depend on the interrupts it receives. These interrupts are prioritized by the importance of the tasks they control.

The MPU is highly integrated and provides most of the decision making logic on the chip. Functions of the MPU include controllers, timers, control logic, address decoding, dual-port RAM and independent direct memory access, parallel input/output ports, and independent full-duplex serial communication channels that support various protocols.

The MPU can be reset by:

— powering up the Remote Carrier Interface card

— the watchdog timer

Memory

The Remote Carrier Interface memory stores the following programs and data:

— Boot code and self-test code are stored in the EPROM.

— Data is stored in the RAM.

— Code that is downloaded by the system CPU to the Remote Carrier Interface card and main MPU function code are stored in the RAM.

— Data containing the Remote Carrier Interface card identification and version is stored in the EEPROM.

Card-LAN interface

To implement the Card-LAN interface, the Remote Carrier Interface card uses a dual-UART device. One UART channel is a serial communication interface to IPE cards and the other channel is the communication link between the Local Carrier Interface card and the Remote Interface card MPUs over the carrier link. Card-LAN function is performed in the system and it doesn't provide an external physical connection.

The Card-LAN is a 19.2 kbps asynchronous interface. It is used to poll and communicate with IPE cards through the Remote Carrier Interface card to transmit maintenance messages, which include:

— LED control of the IPE card enable/disable

— Peripheral card configuration

— Peripheral card type and version information

IPE interface

The IPE interface links IPE cards to the Remote Carrier Interface MPU using sixteen DS-30X loops, one for each IPE card, and contains the following Remote Carrier Interface circuits:

— Dual formatter that transforms serial peripheral loop information into parallel Integrated Voice and Data (IVD) bus information and parallel IVD bus information to serial peripheral loop information.

— Message handler that performs channel associated signaling to and from the IPE cards. It receives signaling information from the IPE cards; then the MPU accesses this information, interprets it, and sends it to the Local Carrier Interface in the appropriate format. From the Local Carrier Interface, the signaling messages are received and interpreted by the Remote Carrier Interface MPU and sent to the serial peripheral loops in the appropriate format.

— Timeslot interchange that provides the correspondence between the voice and data timeslots on the T1 or E1 carrier link and the timeslots on the IVD bus. Timeslots on the IVD bus correspond directly to the peripheral line card loops.

— Signaling timeslots on each carrier link that handle the signaling to and from the Local Carrier Interface card. It receives signaling information from the Local Carrier Interface card and transmits it to the Remote Carrier Interface card MPU for processing. It also processes the signaling information in the opposite direction by receiving the signaling information from the Remote Carrier Interface card MPU and transmitting it to the Local Carrier Interface card MPU over the T1 or E1 carrier links.

Carrier interface

Each Remote Carrier Interface card provides three T1 or E1 carrier interfaces. The Remote Carrier Interface card can have three primary links or two primary links and one spare. It provides a switch-selectable 1.5 Mbps T1 or a 2.0 Mbps E1 point-to-point transmission facility.

The T1 or E1 carrier interface performs the following functions:

— Connects the system to Remote IPE using one to three T1 or E1 carrier links.

— Provides a distance-selectable switch that selects the distance from the Remote Carrier Interface card to the first signal regenerator such as a repeater, a CSU, or an LTU in the carrier link to be from 0 to 200 m (0 to 655 ft).

— Transmits signaling information across the link by using timeslots 0 and 1 of each carrier.

— T1 line signal coding across the carrier link is B8ZS.

— Extended Superframe (ESF) is preferred (instead of D4) for T1 links because it provides CRC6 error monitoring, which provides end-to-end performance checking.

— E1 line signal coding across the carrier link is HDB3.

— Meridian 1 system is used as the clock source to synchronize the communication between the local and remote sites over carrier links.

— Provides a communication channel between the Local Carrier Interface card MPU and the Remote Carrier Interface card MPU over timeslot 2 of each carrier link. It also multiplexes the system monitor and the SDI port information and transmits it over this carrier timeslot across the link.

— Uses elastic store buffers to store two frames of carrier data stream to compensate for possible information propagation delays between different carriers in the link. This allows for proper timeslot alignment of all the carrier links on the IVD bus.

— Identifies card and firmware versions, which are stored in the EEPROM.

— Monitors transmission quality of T1 or E1 carrier links. If the transmission is degraded or fails, the Remote Carrier Interface card automatically transfers to the spare link, if equipped.

Engineering guidelines

Meridian 1 general system engineering guidelines are described in *Meridian 1 system engineering (553-3001-151)*. The following information deals specifically with engineering guidelines for the Carrier Remote IPE planning and implementation.

Carrier Remote IPE capacity

Meridian 1 physical capacity depends on the system configuration and size. System options 21E, 51, 51C, 61, 61C, 71, 81, and 81C are designed to provide port capacities from tens of ports to thousands of ports. These ports are normally local to Meridian 1. However, by implementing Carrier Remote IPE, some of these ports are located at one or more remote sites.

The system's physical capacity depends on the system type. Systems supporting Carrier Remote IPE service are NT and XT. They provide port capacities from tens of ports to thousands of ports.

The overall system capacity does not change by installing Carrier Remote IPE. The difference between a system with Carrier Remote IPE and without Carrier Remote IPE is the distribution of line cards, that is, the subscriber loops. Carrier Remote IPE allows you to distribute the peripheral equipment at long distances from the system and provide the same functions and features to remote subscribers as to local subscribers.

> ***Note:*** System port capacity may be affected by the capacity of the Local Carrier Interface card, which supports only one IPE module instead of two IPE modules as supported by the standard superloop network card. Call blocking grade of service for the remote voice and data terminals depends on the number of active carriers in the link.

The Carrier Remote IPE capacity can be tailored according to port capacity requirements at the remote site. When planning a Carrier Remote IPE site, you must determine the number of IPE cards that are required to support the existing traffic needs and future requirements. Based on these requirements and the equipment location preference, there are two Carrier Remote IPE hardware options available:

— Carrier Remote IPE column

— Carrier Remote IPE cabinet

Carrier Remote IPE column

The Carrier Remote IPE column consists of the Meridian 1 pedestal, IPE module, and a top cap. One IPE module supports up to 16 line cards, or 256 ports if each line card has 16 ports. If more ports are required, additional IPE modules can be added to the column. A column contains a maximum of four modules. Each IPE module requires one Remote Carrier Interface card located in the IPE module and a corresponding Local Carrier Interface card located in the system network card slot.

> ***Note:*** A superloop network card can support up to two IPE modules. However, in a system with the Carrier Remote IPE configuration, a Local Carrier Interface card supports only one Remote IPE module. This is due to the dedicated carrier link configuration between the Local Carrier Interface card and the Remote Carrier Interface card. Since T1 or E1 carrier links are dedicated to one Remote Carrier Interface card, they cannot be shared between two different IPE modules at the remote site.

Carrier Remote IPE cabinet

The Carrier Remote IPE cabinet consists of an NT1P70/NT1P60 main and an NTBK70 expansion cabinets. The main cabinet supports the Remote Carrier Interface card and up to ten IPE cards or 160 ports. If more ports are required, an expansion cabinet can be installed adjacent to the main cabinet.

These two cabinets are linked with an inter-cabinet cable that plugs into 50-pin connector P1 located at the bottom left-hand corner of each cabinet. This cable extends six peripheral bus DS-30X loops to the first six IPE card slots in the expansion cabinet. One Remote Carrier Interface card located in the main cabinet supports cards in both main and expansion cabinets as long as the expansion cabinet contains no more than six IPE cards installed in the first six IPE card slots. The remaining card slots from 17 through 20 must not be used.

Engineering the T1 carrier link

A T1 carrier link is constructed using twisted-pair wire over the private or public network.

When engineering a carrier link, you must determine the number of links required to support the traffic at the remote site. Local and Remote Carrier Interface cards support from one to three T1 carrier links. These three links can be used as primary links without a spare, or two links can be used as primary and the third link can be used as a spare link. The spare link is used when one of the primary links fails. In that case, the traffic from the failed link is automatically switched to the spare link.

The T1 carrier link used twisted-pair wire. The public network link construction is the responsibility of the local telephone company. The only cable routing that has to be done at the local and remote sites is from the telephone company's telco demarcation point or line terminating unit (LTU) to the system and to the Carrier Remote IPE column or Carrier Remote IPE cabinet.

If a private T1 network is used, the same conditions as with the public network apply, that is, the only cable routing that has to be done at both sites is from the CSU or telco demarcation point to the system and to the Carrier Remote IPE column or Carrier Remote IPE cabinet, assuming that the carrier link already exists and does not have to be constructed.

The local carrier interface and the remote carrier interface to the carrier link are designed for in-house environment carrier protection. To protect the carrier link in the external environment, which is susceptible to lightning, external line protection circuits similar to trunk protection circuits are required before the carrier link exits the building

The carrier link line coding is B8ZS. The source of the clock for the carrier links is the Meridian 1 system. The preferred framing for the T1 link is ESF (D4 is also supported).

Engineering the E1 carrier link

An E1 carrier link can be constructed using coaxial cable or twisted-pair wire over the private or public network.

When engineering a carrier link, you must determine the number of links required to support the traffic at the remote site. Local and Remote Carrier Interface cards support from one to three E1 carrier links. These three links can be used as primary links without a spare, or two links can be used as

primary and the third link can be used as a spare link. The spare link is used when one of the primary links fails. In that case, the traffic from the failed link is automatically switched to the spare link.

The E1 carrier link, in some applications, may use coaxial cable to span the distance between the system and the Carrier Remote IPE. The public network link construction is the responsibility of the local telephone company. The only cable routing that has to be done at the local and remote sites is from the telephone company's demarcation point or line terminating unit (LTU) to the system and to the Carrier Remote IPE column or Carrier Remote IPE Cabinet. If the E1 link uses coaxial cables and BNC connectors, use the NT7R67EA Coaxial Interface Adapter Cable (one RJ -48 to BNC adapter cable for each carrier in the link) and the impedance must be set to 75 Ohm using SW1, SW2, SW5, and SW8 on the Local and Remote Carrier Interface cards (refer to Figure 9 and Figure 15).

An E1 carrier link may use coaxial cable connection from the Meridian 1 system and the Carrier Remote IPE to the corresponding LTU or telco demarcation point, but from there on, the network can use twisted pairs, coaxial cable, microwave, etc. as long as it meets the transmission quality required for E1 carrier communication.

If a private E1 network is used, the same conditions as with the public network apply, that is, the only cable routing that has to be done at both sites is from the LTU or telco demarcation point to the system and to the Carrier Remote IPE column or Carrier Remote IPE cabinet, assuming that the carrier link already exists and does not have to be constructed.

The local carrier interface and the remote carrier interface to the carrier link are designed for in-house environment carrier protection. To protect the carrier link in the external environment, which is susceptible to lightning, external line protection circuits similar to trunk protection circuits are required before the carrier link exits the building.

The T1 carrier link line coding is B8ZS. The E1 carrier link line coding is HDB3. The source of the clock for the carrier links is the Meridian 1 system.

Traffic engineering

Network blocking in Meridian 1 can potentially occur at three stages: the network loop or superloop associated with the originating port (line or trunk), the loop or superloop where the call terminates, and the inter-group junctors bridging the connection between two network groups in a multi-group system.

> *Note:* When carriers are configured with carrier 2 as spare, carrier 0 will always have the sparing priority over carrier 1. If carrier 1 is spared and carrier 0 becomes faulty, carrier 0 will be spared and carrier 1 will be released.

In order to meet the overall Grade Of Service (GOS) requirement of 0.01 network blocking requirement, each blocking component in the network should not be greater than one third of the total blocking. Therefore, the blocking for a call at the originating part of the connection should be 0.0033 or less. It is this blocking probability that yields 660 CCS capacity for a loop and 3500 CCS capacity for a superloop in the traffic engineering procedure.

The engineering of Carrier Remote IPE is equivalent to engineering a segment of the call connection; it should follow the procedure recommended in this document. The rest of the system engineering will not be impacted by this component.

Traffic capacity

Traffic capacities of carriers meeting GOS requirements are summarized in Table 4.

Table 4
Carrier capacity calculations

Carrier Type	T1			E1		
Number of Carriers	1	2	3	1	2	3
Number of Channels	21	42	63	27	54	81
Traffic in CCS	408	1016	1665	575	1384	2235

There are some general guidelines to be followed before you start to engineer a Carrier Remote IPE:

— Traffic engineering for a Carrier Remote IPE with or without Central Office between Local Carrier Interface card and Remote Carrier Interface card is the same. This implies that available channels for any specific configuration in the CO or CO network are at least equal to the channels on the carrier to provide the GOS required.

— One Local Carrier Interface card is connected to one Remote Carrier Interface card only. There is no concentration option on the Carrier Remote IPE.

— One carrier out of two, or one carrier out of three, equipped is allowed to be a spare which serves as a backup during active carrier failure but will not carry traffic under normal conditions.

— Capacity calculation of carriers (E1 or T1) should exclude the spare carrier. In other words, if a spare carrier is provided, the maximum number of channels available for traffic is 42 for T1 and 54 for E1.

— If the number of equipped ports (lines or trunks) is less than the number of channels (or time slots) in the carrier, there will be no blocking at the carrier or superloop. Traffic per port can be up to 36 CCS.

— Non-blocking on a carrier Carrier Remote IPE superloop is not sufficient to guarantee a non-blocking system. Other parts of the call connection need to be considered.

— Traffic requirements for lines or trunks are normally specified by a customer. When it is not specified, the default number of 6 CCS per line, 26 CCS per trunk, 30 CCS per ACD agent and 18 CCS per data port can be used.

— Current digital line card allows 16 voice ports and 16 data ports. Unused data ports can not be used for voice lines. In other words, an Integrated Voice and Data line card can support 16 voice lines or 16 integrated voice and data pairs. A port is the generic term for a line, trunk, or data terminal.

- A trunk card can provide eight trunk ports.
- An IPE module can accommodate 16 cards, of which any combination of cards are permitted.
- Digitone Receiver (DTR) cards should not be installed into the Carrier Remote IPE cabinet or the Carrier Remote IPE module due to the unnecessary use of carrier channels and remote IPE card slots.
- A Carrier Remote IPE cabinet version of the Carrier Remote IPE may consist of a 10-slot main cabinet and 6-slot expansion cabinet providing a maximum or 16 card IPE capacity. There may be cost advantages to equipping Carrier Remote IPE cabinets in a multi-shelf configuration, if a cabinet is equipped with no more than 10 cards.
- All line/trunk cards, card slot and carrier calculations are to be rounded up to the next higher integer number.
- Capacity calculations of lines and trunks allowed per carrier should be rounded down to the next lower number.
- When several IPE modules or Carrier Remote IPE cabinets are required in the configuration, it is preferable to fill up the first IPE module or cabinet card slots until either all slots are filled or the carrier traffic limit is reached before equipping the second one. This way, when adding traffic or cards to the partially filled enclosure, the first module or cabinet will not need re-engineering.
- When no growth is planned, even distribution of traffic among several IPE modules or Carrier Remote IPE cabinets is quite acceptable.
- Carrier Remote IPE cabinet installation guide: (1) 1–10 cards, use a Carrier Remote IPE cabinet. (2) 11–16 cards, use an IPE module. (3) 17–20 cards, use two Carrier Remote IPE cabinets. (4) 21–26 cards, use one IPE module and one Carrier Remote IPE cabinet. (5) 27–32 cards, use two IPE modules. Repeat the same rule for additional card slots required. Of course, the final configuration will also depend on traffic requirements.

Engineering Procedure

The following procedures determine the system terminal configuration for determining system traffic capacity.

Given the number of carriers, calculate ports allowed.

1 Determine traffic capacity at the carriers. Read off the CCS number from Table 4 under the specified number of carriers as the maximum capacity allowed for that carrier size.

2 Determine the number of lines allowed. Divide the CCS number by 6 CCS for line or 26 CCS for trunk or any other numbers provided by the customer.

3 Determine the number of card slots required. The number of lines divided by 16, the number of trunks divided by 8 or the number of integrated voice and data lines divided by 32 to obtain the number of card slots required.

4 An IPE module has 16 card slots, a Carrier Remote IPE cabinet has 10 card slots.

5 If the number of card slots is less than or equal to 16 (or 10), the resulting configuration is within the traffic capacity of the carrier provided.

6 If the number of card slots allowed is greater than 16 (or 10), it means that the carrier can handle more traffic than an IPE module or Carrier Remote IPE cabinet can generate. When all 16 (or 10) card slots are filled, the carrier may still have spare capacity for extra traffic.

Given port CCS, determine the number of carriers required.

1 Multiply the number of lines by CCS per line, the number of trunk by CCS per trunk, etc. and sum them up to obtain the total traffic offered to the carrier.

2 Look up Table 4 under the T1 or E1 column to find the CCS number greater than the calculated number, and find the corresponding carrier number to determine the number of carriers required.

3 If no number in Table 4 is large enough to cover the calculated number, it means that the given configuration and traffic is too large for three carriers. Either the number of ports, or the CCS per port or both have to be reduced. The resulting number has to be less than the entry from Table 4 in order for the carrier to handle the given configuration.

4 If traffic and number of lines have to be maintained, multiple lines of carriers and cabinets will be needed.

5 Be sure to use only columns with 1 or 2 carriers in Table 4, if a spare carrier is to be used.

6 The port counts in the final configuration should be within the slot limitation of the Carrier Remote IPE enclosure (16 for IPE module, 10 for the Main Carrier Remote IPE cabinet and 6 for the Expansion Carrier Remote IPE cabinet).

Engineering Examples

Engineering examples are developed to illustrate the procedure described above. They cover only traffic capacity issues specifically associated with Carrier Remote IPE engineering.

Given the number of carriers to find allowed ports and required enclosures.

Example 1: Three T1 carriers are provided to serve a Carrier Remote IPE. All ports are lines with 6 CCS each.

Find the maximum number of lines three T1 carriers can support.

1 From Table 4, the CCS that can be handled by three T1 carriers is 1665.

2 Divide CCS by 6: 1665/6=277. Traffic generated by 277 lines at 6 CCS each can be supported by three T1 carriers.

3 Calculate card slots: 277/16=17. This number is greater than the 16 slots available in an IPE module.

4 Calculate maximum allowed lines: 16x16=256, or 16x10=160. 256 lines (or 160 lines) with 6 CCS each are the maximum number of lines allowed for each Remote IPE module or Remote IPE cabinet for three T1 carriers.

Configuration for Mixed Sets, Trunks and Data Terminals.

Example 2: A remote data processing center is connected to the main office through private E1 carriers. For reliability purposes, spare carriers are required as backups.

Find the configuration to support 80 integrated voice and data lines at 6 CCS for voice and 14 CCS for data, and 20 trunks at 26 CCS each.

1 From Table 4 under E1 heading, two carriers can serve 1384 CCS (with spare, two carriers are the maximum link size per each Carrier Remote IPE module or Carrier Remote IPE cabinet).

2 Calculate total offered traffic: 80x6 + 80x14 + 20x26 = 1600 + 520 = 2120 CCS. This number is larger than 1384 but less than 2768 (=2x1384). The offered traffic is too much for two carriers but within the capacity of four carriers (two lines of two carrier links). Note that the integrated lines alone generate more traffic (1600 CCS) than two carriers can handle, they need to be split between two IPE modules or Carrier Remote IPE cabinets.

3 Calculate card slots: (80+80)/32 +20/8 = 5 +3 = 8. There are sufficient card slots in one cabinet to handle the required ports. Even though the configuration exceeds the traffic capacity of one carrier group in Step 2, it is still a good idea to check physical constraints to determine whether traffic is the only constraining parameter.

4 Configuration Summary:
IPE1 (Carrier Remote IPE cabinet): 3 32-port IVD cards, 1 trunk card, 3 E1 carriers including one spare.
IPE2 (Carrier Remote IPE cabinet): 2 32-port IVD cards, 2 trunk cards, 3 E1 carriers including one spare.

Given ports and traffic to find carriers and cabinets. Non-blocking Sets Only (two Carrier Remote IPE cabinets)

Example 3: A Carrier Remote IPE is located in an airport fire station two miles from the main terminal building where the Meridian 1 is installed. There are 80 lines in the Carrier Remote IPE where non-blocking network and a spare carrier on the carrier group are required. What is the most cost effective configuration to serve this site?

1 To provide non-blocking to 80 lines, 80 channels are required at the carrier.

2 From Table 4, two T1 carriers can provide 42 channels, which are just enough to serve half of the requirement.

3 Calculate card slots: 80/16 = 5. Only five card slots are needed for this application. However, if three cards are fully equipped with lines in one IPE module or Carrier Remote IPE cabinet, the 48 lines will exceed the channel capacity of two-carriers at 42 for non-blocking. Three partially equipped cards are needed. The total ports should be 42 or less at any IPE module or Carrier Remote IPE cabinet.

4 Configuration Summary:
IPE1 (Carrier Remote IPE cabinet): 42 non-blocking lines, 3 cards, 3 E1 carriers including one spare.
IPE2 (Carrier Remote IPE cabinet): 38 non-blocking lines, 3 cards, 3 E1 carriers including one spare.

To split lines 40-40 in this application is also acceptable. However, future growth should be kept to 42 lines maximum at each cabinet.

Blocking Network (one IPE module and one Carrier Remote IPE cabinet)

Example 4: A university providing E1 carrier telephone services to 400 boarding students is located one mile away from the main administrative building where the Meridian 1 is located.

Find the configuration required to serve this remote site, if the estimated busy hour per line is 6 CCS.

1 Calculate traffic: 400x6 = 2400 CCS. This number is greater than the capacity of 3 E1 carriers (2235 CCS). From a traffic standpoint, two IPE modules are needed.

2 Calculate card slots: 400/16 = 25. This also indicates that two IPE modules are needed. However, one IPE Module with 16 card slots and a Carrier Remote IPE cabinet with 10 card slots are sufficient to meet the need.

3 Calculate traffic, card slots and carriers for the first IPE module:
2235/6 = 372 lines.
372/16 = 24 cards. This number is > 16. Only 16 cards are allowed for the first IPE module.
16x16 = 256. 256 lines at 6 CCS each is equipped for the first IPE module
256x6 = 1536 CCS. From Table 3, this number still requires three E1 carriers.

4 Calculate traffic, card slots and carriers for the second IPE module or Carrier Remote IPE cabinet:
Remaining lines: 400-256 = 144
Card slots: 144/16 = 9
Traffic: 144x6 = 864 CCS
Carriers required: From Table 4, 2 E1 carriers can handle 1384 CCS which should be enough to serve the 864 CCS from 144 lines (but one carrier at 575 CCS is not quite enough).

5 Configuration Summary:
IPE1 (IPE module): 6 CCS/line, 256 lines, 16 cards, three E1 carriers.
IPE2 (Carrier Remote IPE cabinet): 6 CCS/line, 144 lines, 9 cards, twoE1 carriers.

System planning and ordering

Meridian 1 and SL-1 systems provide the user with a variety of system size and feature options. To select a system option that will best suit your current and future communication needs, you must carefully plan your system. Contact your Nortel Networks representative or your Nortel Networks distributor to help you plan the system.

If you are installing a new Meridian 1 with Carrier Remote IPE, refer to *Meridian 1 installation planning (553-3001-120)* and *Meridian 1 system engineering (553-3001-151)* for overall system information. To obtain specific planning and ordering information for T1 and E1 carrier links interfacing with network and peripheral cards, see the following sections.

System selection

Determine the type of Carrier Remote IPE enclosure. This selection may be dictated by the installation preference, blocking considerations, and the number of IPE cards required at the remote site.

If you plan a floor-standing system, you can use the Carrier Remote IPE column or the pedestal mounted Carrier Remote IPE cabinet. If you plan a wall-mounted system, you need the Carrier Remote IPE cabinet.

In some applications where nonblocking or low blocking traffic considerations are important, you have to limit the number of peripheral cards supported by each Remote Carrier Interface card. For a nonblocking condition, the 63 voice/data timeslots for three T1 carriers support four 16-port line cards; the 81 voice/data timeslots for three E1 carriers support five 16-port line cards. Each additional line card in the IPE module or the Carrier Remote IPE cabinet increases call blocking under high traffic conditions. Refer to *Meridian 1 system engineering (553-3001-151)* for traffic calculations.

With a spare carrier for a nonblocking traffic condition, the number of stations is reduced by 21 for the T1 carrier and by 27 for the E1 carrier.

The system type may also be dictated by the number of ports required at the remote site. The modular column configuration supports 16 line cards and provides a maximum of 256 ports. This column can be expanded by adding a second IPE module to support an additional 256 ports. Each IPE module, however, requires a Remote Carrier Interface card at the remote site and a corresponding Local Carrier Interface card at the local Meridian 1 or SL-1 site.

In addition to line cards, the Carrier Remote IPE supports all the cards that do not require external connection to the system common or network equipment.

The Carrier Remote IPE cabinet system configuration supports ten line cards. You may want to select the Carrier Remote IPE cabinet system type if your system size requirement is less than ten IPE cards. To expand this type of system beyond ten IPE cards, you must add a Carrier Remote IPE expansion cabinet adjacent to the main and install up to six IPE cards into the first six IPE card slots of the expansion cabinet.

Carrier Remote IPE site planning

When you select a site for your Carrier Remote IPE, you must consider the number of ports currently required at the site and the possibility of expansion to meet future needs. You also must consider the environmental, power, and cable routing requirements.

Environmental requirements

Carrier Remote IPE equipment conforms to the same environmental requirements as the system equipment. Temperature, humidity, and altitude for the system operation should not exceed the specifications shown in Table 5.

Table 5 shows the operating and storage environmental specifications. Ideally the system should operate in a stable environment at 22° C (72° F). However, the system is designed to operate in the temperature and humidity ranges specified in Table 5.

Table 5
Environmental requirements

Condition	Environmental specifications
Operating	
Temperature	0° to 50° C (32° to 122° F)
Relative humidity	5% to 95% noncondensing
Altitude	3,048 meters (10,000 feet) max
Storage	
Temperature	–50° to 70° C (–58° to 158° F)
Relative humidity	5% to 95% noncondensing

Power requirements

At the remote site, cards in the IPE module are powered by the power supply installed on the left-hand side of the IPE module. The power consumption of the Remote Carrier Interface card is not significantly different from power consumption of the standard Peripheral Controller card. This allows the standard IPE module's power supply to be used in the Carrier Remote IPE column.

Similarly, the Carrier Remote IPE main cabinet power supply, which is installed in the left-hand side of the cabinet shelf, provides power to the Remote Carrier Interface card and up to ten IPE cards. The expansion cabinet requires its own separate power supply to provide power to an additional six IPE cards.

The Carrier Remote IPE cabinet can be powered with an AC power system using the NTAK04 AC/DC power supply.

It can also be powered with a DC power system using the NTAK05 DC power supply from a –52 V battery source through the NTAK28AA Junction box and the NTAK410 power cable. For additional information refer to *Option 11 Installation guide* 553-3011-210.

Table 6 shows the power supply DC output voltages and currents they supply to the Local Carrier Interface (LCI) and Remote Carrier Interface (RCI) cards. It also shows the corresponding total power consumption for each card.

Table 6
LCI and RCI power requirements

Voltage source in VDC	LCI card	RCI card
+5V	4.0 A	3.7 A
+15V	70 mA	50 mA
–15V	70 mA	50 mA
+12V	70 mA	50 mA
–12V	70 mA	50 mA
Total Power	23.8 W	21.2 W

Carrier cable requirements

A link can include up to three carriers. In a Carrier Remote IPE column, the carrier link terminates into the I/O panel connectors at the rear of the IPE module. In a Carrier Remote IPE cabinet, the carrier link terminates into the I/O panel connectors mounted on a bracket at the lower left-hand side at the front of the Carrier Remote IPE cabinet.

The Carrier Remote IPE UEM column and the Carrier Remoter IPE cabinet support T1 or E1 carrier links. These carrier links are terminated as follows:

— T1/E1 carrier links use twisted-pair wires (120-ohm impedance) and terminate into 8-pin modular jacks.

— E1 carrier links may in some cases use coaxial cables (75 ohm impedance) and terminate into BNC connectors, requiring a RJ48 to BNC adapters (supplied with the equipment) to connect the link to the Carrier Panel assembly at the UEM I/O panel.

Carrier equipment planning form

Table 7 displays a planning form to use when ordering your carrier equipment. Enter the part number and the quantity for each item required at the local and the remote site.

Table 7
Planning form

Select one carrier type: T1 or E1 (circle the selected carrier type and enter only items required for that carrier type). Refer to Tables 1–3.			
Item	**Part Number**	**Quantity at Meridian 1**	**Quantity at Remote IPE**

Equipment installation and configuration

Reference list

The following are the references in this section:

- *Software Conversion Procedures* (553-2001-320)
- *M1250 and M2250 Attendant Consoles: Description* (553-2201-117)
- *Meridian 1 Serial Data Interface Cards: Description* (553-3001-107)
- *Installation Planning* (553-3001-120)
- *System Engineering* (553-3001-151)
- *Power Engineering* (553-3001-152)
- *System Installation Procedures* (553-3001-210)
- *Circuit Card: Installation and Testing* (553-3001-211)
- *Telephone and Attendant Console: Installation* (553-3001-215)
- *Upgrade System Installation* (553-3001-258)

This chapter describes the installation of the Carrier Remote IPE as an integral part of system options 21E, 51, 51C, 61, 61C, 71, 81, and 81C as well as NT and XT systems.

Quick reference to system installation and configuration

If you are familiar with the system operation and general Meridian 1 installation practices, follow the steps below and refer to Appendix C for connection diagrams, to speed up the installation of the Remote Carrier IPE at the local and remote sites:

1 Take inventory of the carrier equipment by comparing the received equipment against the shipping documents. Refer to Table 1, Table 2, and Table 3 in the *Carrier Remote IPE product description* chapter on page 13 for carrier components part numbers and their description.

2 Identify empty network card slots, refer to:

- Table 8 "Meridian 1 modules supporting Local Carrier Interface cards" on page 71 or
- Table 9 "System cabinet shelves supporting Local Carrier Interface cards" on page 72 and

3 Configure the NT7R51 Local Carrier Interface card DIP-switches to set the Local Carrier Interface card address and other parameters. Refer to:

- Figure 9 "Local Carrier Interface card DIP-switch positions and function" on page 80 for switch settings.
- Table 11 "NT7R51 Local Carrier Interface card maintenance daisy-chain address" on page 81.

4 Install the NT7R51 Local Carrier Interface card into a network card slot:

- "Installing the Local Carrier Interface card" on page 78, for Meridian 1 system options.
- "Installing the Local Carrier Interface card" on page 104, for NT/XT systems.
- Figure 14 "Local Carrier Interface card faceplate cable connections in NT or XT system" on page 105.

5 Install the NT7R51 Local Carrier Interface card faceplate connector assemblies. Refer to:

- "Installing the Local Carrier Interface cable assemblies" on page 82 and
- Appendix C, Figure 27 and Figure 28, and
- Figure 10 "Local Carrier Interface card faceplate cable connections in Meridian 1" on page 84 or
- Figure 14 "Local Carrier Interface card faceplate cable connections in NT or XT system" on page 105 and
- "Installing Local Carrier Interface faceplate cables" on page 106.

6 Install the system monitor, local MMI terminal, and carrier link cables to the carrier and maintenance panel assembly connectors. Refer to:

- "Installing SDI and local MMI terminal cables" on page 87, and
- Appendix C, Figure 31.
- "Connecting the carrier link to the Meridian 1" on page 101, and
- Figure 11 "System monitor, local MMI terminal, and carrier links cable connections" on page 89.
- Refer to Appendix C on page 233 for connector pin assignments.

7 At the remote site, install the Carrier Remote IPE column or wall-mounted (or pedestal mounted) Carrier Remote IPE cabinet. Refer to:

- "Installing the Carrier Remote IPE column" on page 115 or
- "Installing the Carrier Remote IPE cabinet" on page 129.

8 Configure the NT7R52 Remote Carrier Interface card. Refer to:

- Figure 15 "Remote Carrier Interface card DIP-switch locations and functions" on page 119 for switch settings and
- "Installing system monitor cables" on page 125.

Note: For the floor-standing Carrier Remote IPE column, select the system monitor address on the Remote Carrier Interface card and on the System Monitor card in the pedestal. The system monitor address in both places must be the same and a unique number from 0 to 31.

9 Install the NT7R52 Remote Carrier Interface card into the ***Cont*** card slot in the IPE Module or the Carrier Remote IPE cabinet. Also install the power supply and the IPE cards.

10 Install the internal cable assemblies. Refer to:

- "Installing the backplane cable assemblies" on page 121 and
- Appendix C, Figure 29, and
- Figure 16 "Backplane to I/O panel connections on the IPE module" on page 124 for the Carrier Remote IPE column, or refer to
- "Installing the NT7R94AA Remote Cabinet Cable Assembly" on page 134 and
- Appendix C, Figure 30, and
- Figure 18 "Carrier cable routing for the Carrier Remote IPE cabinet" on page 135 for the Carrier Remote IPE cabinet.

11 Install the external cables to the I/O panel. Refer to:

- "Installing system monitor cables" on page 125 and
- Appendix C, Figure 29, and
- "Connecting the carrier link to the Remote IPE module" on page 127 for the Carrier Remote IPE column, or refer to
- "Connecting carrier links to the Carrier Remote IPE cabinet" on page 137 and
- Appendix C, Figure 30, and
- "Connecting remote MMI terminal and subscriber loop cables" on page 140 for the Carrier Remote IPE cabinet.
- "Verifying carrier link connections at the remote site" on page 159
- Refer to Appendix C on page 233 for connector pin assignments.

12 Configure the Carrier Remote IPE local and remote sites. Refer to:

- "Configuring the carrier interface cards" on page 145 and
- "Configuring the remote MMI terminal port" on page 150.
- "Configuring the carriers" on page 153.

13 Conduct system acceptance testing. Refer to:

- "Carrier Remote IPE acceptance testing" chapter on page 165 in this manual.

Installation overview

Carrier Remote IPE service can be added to existing Meridian 1 system options 21E, 51, 51C, 61, 61C, 71, 81, and 81C originally installed and operating without Carrier Remote IPE, or it can be an integral part of a newly installed Meridian 1 system.

The Remote IPE service can also be added to NT and XT systems with X11 Release 21 or higher generic software.

In either case, the connection of the Carrier Remote IPE to the system over T1 or E1 carrier links should begin after a previously installed system, or a newly installed system using generic software X11 Release 21 or higher operates correctly. The system must also be equipped with Carrier Remote IPE software package REM_IPE 286. The carrier service has been ordered, installed, and tested up to the telco demarcation point.

To install a new Meridian 1 system or expand an existing one, refer to *System Installation Procedures* (553-3001-210). It provides the information on how to install, verify, and maintain the Meridian 1 system.

To upgrade NT and XT systems to X11 Release 21 or higher, refer to *Software Conversion Procedures* (553-2001-320).

Adding one or more Carrier Remote IPE sites to a system is treated as a straightforward system expansion, that is, the system should be fully operational before the Carrier Remote IPE equipment is installed and connected to the system. This simplifies installation and fault isolation during installation.

Carrier Remote IPE is offered in two versions to provide flexibility in line size and equipment location. These are:

— Carrier Remote IPE column

— Carrier Remote IPE cabinet

Note: The Carrier Remote IPE column consists of a pedestal, an IPE module that houses up to 16 IPE cards, and a top cap. The Carrier Remote IPE cabinet may consist of only the main cabinet when 10 or fewer IPE cards are required, or the main and the expansion cabinets when up to 16 IPE cards are required.

To complete the installation of a Carrier Remote IPE site, you should perform the preinstallation procedures to prepare the site before installing and connecting the equipment. The general preinstallation and installation points are listed below. The actual installation procedure steps start in "Meridian 1 equipment installation" on page 77.

Preinstallation procedures include:

— ordering carrier service from telco

— preparing the site

— unpacking and inspecting the equipment

— inventorying Carrier Remote IPE and system carrier equipment

— selecting a network slot for the Local Carrier Interface card

Local site installation procedures include:

— installing the Local Carrier Interface card into the selected network card slot

— installing cables between the Local Carrier Interface faceplate connectors and the I/O panel assembly at the rear of the Meridian 1 module housing the Local Carrier Interface card or the NT or XT system cabinet

— connecting the system monitor daisy-chain, the Meridian 1 host SDI, and the MMI terminal cables at the local system site

— connecting the Local Carrier Interface maintenance cables in a daisy-chain for multiple Local Carrier Interface cards

— connecting the carrier link to the I/O panel assembly

Remote site installation procedures include:

— installing the Carrier Remote IPE column or cabinet

— installing the Remote Carrier Interface card into the Remote IPE module or cabinet controller card slot

— installing cables between the backplane connectors behind the Remote Carrier Interface card and the I/O panel assembly at the rear of the module or the bottom of the Carrier Remote IPE cabinet

— connecting the slave system monitor and MMI terminal cables at the Carrier Remote IPE site

— connecting the carrier link to the Carrier Remote IPE

Preinstallation preparation

Preinstallation preparation consists of preparing the site, unpacking and inspection, taking inventory, selecting the network slot for the Local Carrier Interface card, installing the card, selecting the T1 or E1 carrier link, and preparing the remote site cables, grounding, power source, and the space for the Remote IPE column or cabinets.

Preparing the site

When preparing a site, you must address environmental, structural, and electrical factors. These factors must be considered for the entire system, that is, Meridian 1 and Carrier Remote IPE sites. This information is available in:

— *Installation Planning* (553-3001-120)

— *System Engineering* (553-3001-151)

— *Power Engineering* (553-3001-152)

Note: The NT and XT systems have been previously installed and are only upgraded for Carrier Remote IPE service. If these systems have been upgraded using Meridian 1 column, you can use the system monitor in the pedestal to process system alarms received from the Carrier Remote IPE site. Without the system monitor in the pedestal, the system alarms from the Carrier Remote IPE site cannot be processed.

To prepare the site for Carrier Remote IPE installation, you must first:

— Install and verify the operation of Meridian 1, without linking Meridian 1 to the Carrier Remote IPE sites. Refer to *System Installation Procedures* (553-3001-210). An NT or XT system should have already been installed and must be operational.

— Install the Carrier Remote IPE column. Also refer to *System Installation Procedures* (553-3001-210), or

Install the cabinet version of Carrier Remote IPE as described in "Installing the Carrier Remote IPE cabinet" on page 129 in this chapter.

Unpacking and inspection

Unpack and inspect the equipment for damage. When unpacking, follow general precautions recommended by computer and telephone equipment manufacturers:

— Remove items that generate static charge from the installation site.

— Use antistatic spray if the site is carpeted.

— Ground yourself using a wrist strap and an antistatic mat before handling any equipment.

— Remove equipment carefully from its packaging.

— Visually inspect the equipment for obvious faults or damage. Any damaged component must be reported to your sales representative and the carrier who delivered the equipment.

— Hold the plug-in cards by their nonconductor edges and keep them in their antistatic bags until you are ready to install them.

— Do not stack the plug-in cards on top of each other.

Taking inventory

After the equipment has been unpacked and visually inspected, verify that all the equipment is at the site before the installation begins. Equipment received must be checked against the shipping documents. Any shortages must be noted and reported to your sales representative. Refer to Table 1, Table 2, and Table 3 in the *Carrier Remote IPE product description* chapter on page 13 for carrier equipment description.

Routing carrier links to the Carrier Remote IPE site

A carrier link connecting the system to the Carrier Remote IPE can use a private or a public T1 or E1 network. The carrier link can consist of one to three T1 or E1 carriers.

A carrier link terminates in a telco demarcation point and from the telco demarcation point, carrier links are routed to the intended telecommunications equipment. The distance between the system or Carrier Remote IPE and the first T1 or E1 repeater, the CSU, or the LTU should not exceed 200 m (655 ft). Therefore, the system and the Carrier Remote IPE should be located within 200 m from their respective telco demarcation points and the first repeater boxes. The actual distance is DIP-switch selectable on the Local and Remote Carrier Interface cards.

> ***Note:*** The NT7R87AA T1 CSU Cable Kit provided with the Carrier Remote IPE equipment is used to connect the Local and Remote Carrier Interface cards to CSUs at a distance of 32 feet (9.75 m). Install this cable kit, if applicable, between the telco demarcation point (CSU) and the Local Carrier Interface card at the local site and the Remote Carrier Interface card at the remote site as a preinstallation procedure.

Route twisted pairs for T1 or E1 carrier links from the telco demarcation point to the carrier equipment. Use standard cable routing procedures to prevent cable exposure to possible damage from contact with machine and human traffic. Terminate the twisted-pair wires with 8-pin modular plug. If coaxial cables are used, they must be terminated with BNC-type connectors.

> ***Note:*** For an E1 carrier system that uses coaxial cable, the impedance must be set on the Local and Remote Carrier Interface card to 75 Ohm. Refer to Figure 9 and Figure 15 to set SW1, SW2, SW5, and SW8 for E1 carrier impedance of 75 Ohm.

Selecting the Local Carrier Interface card slot

The position of the Local Carrier Interface card in Meridian 1 depends on the Meridian 1 system option installed at the local site. The system option determines in what type of module the card will be housed.

CAUTION

Check if the module is equipped with BTUs that protrude between card slot connectors in the network shelf. Make sure that you do not attempt to install the Local Carrier Interface card in the card slot immediately to the left of a BTU. If Network Hybrid Kit NT5D40AA is use instead of BTUs, you can install the Local Carrier Interface card into any superloop network card slot with the network hybrid.

Table 8 lists modules that provide network card slots, the system options where these modules are used, and card slots where network cards can be installed. Card slots that may be physically restricted by BTUs are identified by a Note in Table 8 and Table 9. You can also use the right-hand superloop card slots if the slot does not have a BTU

Table 8
Meridian 1 modules supporting Local Carrier Interface cards

Modules	System option	Network card slot
NT5D21 Core/Network Module	51C, 61C, 81C	0-7
NT8D11 CE/PE Module	21E	4-9
NT8D35 Network Module	71, 81, 81C	5-10, 11&12 (Note)
NT9D11 Core/Network Module	61C	0&1 (Note), 2-7
NT6D39 CPU/Network Module	51, 61	1&2 (Note), 3-8

Note: Card slot 11 and 12 can be used with NT8D35BA and NT8D35EA vintage Network Modules or Network Modules with NT8D3507 backplane, which are equipped with network Hybrid Kit NT5D40AA instead of BTUs. In older vintage NT8D35 Network Modules, NT9D11 Core/Network Modules, and NT6D39 CPU/Network Modules, a BTU upgrade kit can be used to replace the BTUs to be able to use the card slots identified with the **Note** for the installation of the Local Carrier Interface card.

The NT5D40AA Hybrids Kit includes four network hybrids require to replace two BTUs in a single network shelf or module. The kit also includes the extraction tool that must be used if a network hybrid has to be removed.

Table 9 lists NT and XT cabinet shelves that provide network card slots, the systems where these shelves are used, and card slots where network cards can be installed. You can also use the right-hand superloop card slots if the slot does not have a BTU.

Table 9
System cabinet shelves supporting Local Carrier Interface cards

System Shelf	System	Network card slot
Network shelf (QSD39)	NT, XT	3 (Note), 4-10
Network shelf (QSD40)	NT, XT	5-10, 11&12 (Note)
Note: To use 3, 11, or 12 network card slots, a BTU upgrade kit should be used. This NT5D40AA Hybrid kit replaces BTUs in the network shelf.		

Network card slots in the modules and shelves listed house other network-type cards that are contending with the Local Carrier Interface card for space in the module or shelf. If one or more network card slots are empty, the choice of where to install the Local Carrier Interface card is shown in the following section.

> ***Note:*** Each network card slot supports two network loops. Although an NT8D04 Superloop Network card physically occupies only one card slot, it occupies four network loops.

Selecting the I/O Panel connector cutouts to install the Carrier I/O panel assemblies

Meridian 1 systems contain Network Modules and modules that contain network card slots among card slots for common and sometimes peripheral equipment. Each module type has a different I/O panel and may or may not have connector cutouts suitable for installation of the carrier remote panel assemblies.

Before you install the carrier panel assemblies into the I/O panel connector cutouts, you should carefully select the appropriate connector cutouts, identify their connector number, and use the Carrier Remote IPE Connection Record label below to record the installation characteristics for each Local Carrier Interface card.

Network Module I/O Panel connector cutouts selection

When installing the carrier remote panel assemblies for each Local Carrier Interface card, use the recommendations listed below:

— Use Local Carrier Interface card I/O extension cables, NT7R69AA and NT7R69BA, if it is necessary to reach available I/O panel connector cutouts in other network modules or Core/IF modules.

— When installing multiple Local Carrier Interface cards and their respective carrier panel assemblies into a Network Module, use the following recommendations for the P0745716 Universal I/O panel:

- Left I/O Panel:
  For the first Local Carrier Interface card, install the NT7R57AA Carrier Panel Assembly into the I/O panel connector cutout J22 and the NT7R58AA Maintenance Panel Assembly into the connector cutout J26.
- Right I/O Panel:
  For the second Local Carrier Interface card, install the NT7R57AA Carrier Panel Assembly into the I/O panel connector cutout J2 and the NT7R58AA Maintenance Panel Assembly into the connector cutout J6.

Carrier Remote IPE Module I/O panel connector selection

— When installing the carrier remote panel assemblies for the Remote Carrier Interface card at the rear of the IPE Module, use the recommendations listed below:

- Left I/O Panel:
  Install the NT7R59AA Carrier Panel Assembly into the J4 connector cutout.
  Install the NT7R60AA Carrier/Alarm Panel Assembly into the J5 connector cutout.
- Right I/O Panel:
  Install the NT7R61AA Maintenance Panel Assembly into the J2 connector cutout.

— Locate connector cutouts that are 2.25 inches high on the I/O panel at the rear of the module containing the Local Carrier Interface card.

Note: Some old network modules have 2.00 inch connector cutouts, which are not suitable for carrier panel assembly installation. To be able to install these carrier panel assemblies, you must replace the module's I/O panels with the latest version that have 2.25 inch connector cutouts.

— Use the left-hand-side I/O panel connector cutouts for the Local Carrier Interface card carrier panel assemblies installation to avoid cable congestion on the right-hand side, if possible.

— Use side-by-side connector cutouts for the Local Carrier Interface card panel assemblies starting at the top of the I/O panel. This avoids obstruction of internal cable-way and associates the carrier panel assemblies with their respective Local Carrier Interface cards.

Note: The current left-hand I/O panel for the Network Module has the highest numbered connector position (J38) in the lower left-hand corner. Older left-hand-side I/O panels on the Network Modules have the highest numbered connector position (J28) in the lower left-hand corner.

— This older Network Module Universal I/O panel such as P075058 can accommodate only one set of carrier panel assemblies, which correspond to one Local Carrier Interface card. Side-by-side connector cutouts suitable for carrier panel assembly installation are:

- Left I/O Panel:
  For the first Local Carrier Interface card, install the NT7R57AA Carrier Panel Assembly into the I/O panel connector cutout J17 and the NT7R58AA Maintenance Panel Assembly into the connector cutout J16.
- Right I/O Panel:
  For the second Local Carrier Interface card, install the NT7R57AA Carrier Panel Assembly into the I/O panel connector cutout J2 and the NT7R58AA Maintenance Panel Assembly into the connector cutout J1.

Carrier Remote IPE connection record label

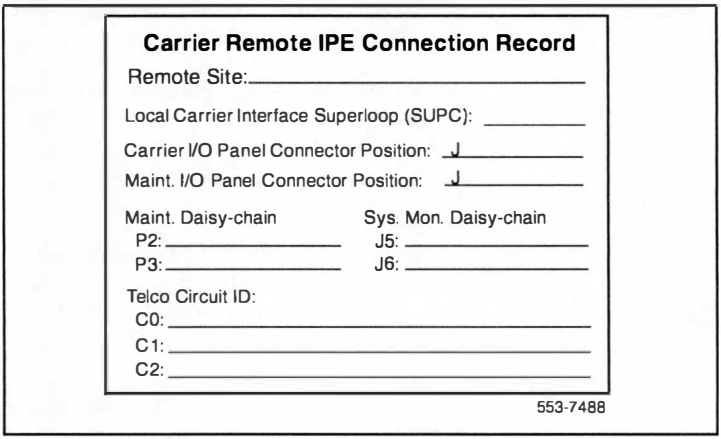
Affix this label (Figure 8) at the rear of the module housing the Local Carrier Interface card(s). Place the label at the same level as the corresponding I/O panel connector cutouts used to install its Carrier and Maintenance Panel Assemblies for that specific Local Carrier Interface card. If the label is not available, make your own and paste them on the module.

Label entries description:
Remote Site—Name of the Remote Carrier IPE site associated with this Local Carrier Interface card superloop number (SUPC)

Local Carrier Interface Superloop (SUPC)—Enter here the designated superloop number for this specific Local Carrier Interface card.

Carrier I/O Panel Connector Position—Enter the number of the selected connector cutout on the I/O panel where the Carrier Panel Assembly is installed, for example J22.

Figure 8
Carrier Remote IPE Connection Record label



Maint. I/O Panel Connector Position—Enter the number of the selected connector cutout on the I/O panel where the Maintenance Panel Assembly is installed, for example J26.

Maint. Daisy-chain—Enter the appropriate information for P2 and P3 connectors of the NT7R67DA Local External Maintenance Cable Assembly to identify what they are connected to. They can be connected as follows (refer to Figure 12 on page 96):
P3 can be connected to the; **MMI terminal** or to **P2 of SUPCxxx**.
P2 can be connected to the; **Host SDI port x**, or **P3 of SUPCxxx**.
where **xxx** in SUPCxxx is the superloop number of the Local Carrier Interface card in the daisy-chain.

Sys. Mon. Daisy-chain—Enter the appropriate information for J5 and J6 modular jacks to identify what they are connected to. They can be connected as follows (refer to Figure 13 on page 100):
J5 can be connected to; **J6 of Master Sys. Mon.**or to the next **slave system monitor** in the direction of the **master system monitor**, or to the next **LCI SUPCxxx J6** in the direction of the **master system monitor**.
J6 can be connected to; **J5** of the next **system monitor** in the direction away from the **master system monitor**, or to **J5** of the next **LCI SUPCxxx** in the direction away from the **master system monitor,** where **xxx** in SUPCxxx is the superloop number of the Local Carrier Interface card in the daisy-chain.

Telco Circuit ID—Enter the telco circuit ID number for each carrier link coming from the telco demarcation point.
For a collocated installation, where telco network is not used, specify the cable pairs used for each carrier link.

Meridian 1 equipment installation

To complete the installation of the T1 or E1 carrier interface that links the system to the Carrier Remote IPE equipment, you must:

— install and verify the operation of the system, if not already installed and operating correctly

— identify the network card slot and install the Local Carrier Interface card in the system

— install the faceplate cables

— connect the cable to the SDI, the system monitor, and the TTY ports

— connect the carrier link to the I/O panel assembly

Installing and verifying system operation

The Carrier Remote IPE facilities can be added to an existing Meridian 1 system running on X11 Release 21 or later and carrier software REM_IPE 286 by installing the appropriate carrier equipment into the system, installing one or more Carrier Remote IPEs at different remote sites, and linking Meridian 1 with remote sites using T1 or E1 links.

To install a new Meridian 1 system, follow the instructions in *System Installation Procedures* (553-3001-210). It describes how to install a complete Meridian 1 system.

If a new Meridian 1 system is configured with Carrier Remote IPE facilities, the system will normally be assembled at the factory with the Local Carrier Interface and the associated cards already installed and internal cables connected between the Local Carrier Interface card faceplate and the I/O panel assembly at the rear of the module housing this card. After the system is installed, you have to connect the T1 or E1 carrier links to the Meridian 1 and the Carrier Remote IPE I/O panel assembly T1 or E1 connectors. However, if the Local Carrier Interface card is not installed, follow the steps in the next section.

Installing the Local Carrier Interface card

The following steps show you how and where to install the Local Carrier Interface cards. In a new system, the card is shipped installed in a network card slot from the factory. However, you may have to install additional Local Carrier Interface cards to expand the number of remote sites or replace a defective card. The card can be installed when the system is powered up and running. Table 12 lists the default (factory provided switch settings) on the Local Carrier Interface card. Verify the switch settings before installation.

To install these cards:

1 Set the ENB/DIS switch on the NT7R51 Local Carrier Interface card to DIS.

2 Set the DIP switches to specify the carrier type (T1 or E1), the distance to the first signal regenerator (repeater, CSU, or LTU), the MMI terminal baud rate, the card site (local), and the card address in a daisy-chain, as shown in Figure 9. The DIP switch setting will depend on the physical system configuration. Figure 9 shows that carriers are selected for T1 transmission because all the switches from SW2 through SW10 are pointing towards T1 positions. Also SW1 position 8 selects T1 or E1 in firmware.

3 Pull the NT7R51 Local Carrier Interface card locking devices away from the faceplate. Holding the card by these locking devices, insert it into the card guides of the selected network card slot. Make sure the card slot does not have a BTU installed in that position. Verify that there is no BTU obstructing the card slot.

4 Slide the card into the module until it engages in the backplane connector.

5 Carefully push the locking device levers toward the faceplate to insert the card connector into the backplane connector and lock the card in place.

6 Set the ENB/DIS switch on the NT7R51 Local Carrier Interface card to ENB and observe the card LED at the top of the faceplate as the Local Carrier Interface card performs self-tests. The card LED should blink three times and then stay on until enabled by software. When enabled by software, the card LED turns off permanently, as long as the card is operational. Refer to "LED indicators" on page 178 for more information about the Local Carrier Interface card carrier and maintenance LEDs.

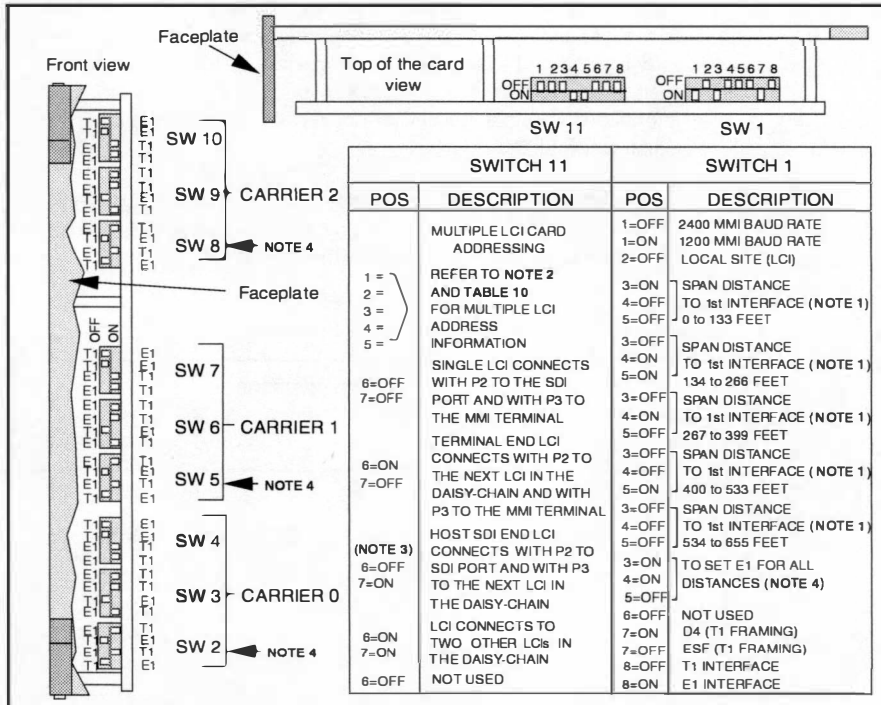
Note: When the ENB/DIS switch is switched to ENB, it also enables the carrier clocking. This allows the T1 carrier links to be tested even before the Local Carrier Interface card is software enabled.

Table 10
Local Carrier Interface standard (default) switch settings

Switch	Switch positions							
	1	2	3	4	5	6	7	8
SW1	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
SW11	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
SW2	OFF	ON	OFF	ON	-	-	-	-
SW3	ON	OFF	ON	ON	-	-	-	-
SW4	ON	ON	OFF	OFF	-	-	-	-
SW5	OFF	ON	OFF	ON	-	-	-	-
SW6	ON	OFF	ON	ON	-	-	-	-
SW7	ON	ON	OFF	OFF	-	-	-	-
SW8	OFF	ON	OFF	ON	-	-	-	-
SW9	ON	OFF	ON	ON	-	-	-	-
SW10	ON	ON	OFF	OFF	-	-	-	-

Figure 9 shows the Local Carrier Interface card DIP switches SW1 through SW11 and their functions.

Figure 9
Local Carrier Interface card DIP-switch positions and function



SWITCH 11		SWITCH 1	
POS	DESCRIPTION	POS	DESCRIPTION
	MULTIPLE LCI CARD ADDRESSING	1=OFF 1=ON 2=OFF	2400 MMI BAUD RATE 1200 MMI BAUD RATE LOCAL SITE (LCI)
1 = 2 = 3 = 4 = 5 =	REFER TO **NOTE 2** AND **TABLE 10** FOR MULTIPLE LCI ADDRESS INFORMATION	3=ON 4=OFF 5=OFF	SPAN DISTANCE TO 1st INTERFACE (NOTE 1) 0 to 133 FEET
6=OFF 7=OFF	SINGLE LCI CONNECTS WITH P2 TO THE SDI PORT AND WITH P3 TO THE MMI TERMINAL	3=OFF 4=ON 5=ON	SPAN DISTANCE TO 1st INTERFACE (NOTE 1) 134 to 266 FEET
6=ON 7=OFF	TERMINAL END LCI CONNECTS WITH P2 TO THE NEXT LCI IN THE DAISY-CHAIN AND WITH P3 TO THE MMI TERMINAL	3=OFF 4=ON 5=OFF	SPAN DISTANCE TO 1st INTERFACE (NOTE 1) 267 to 399 FEET
		3=OFF 4=OFF 5=ON	SPAN DISTANCE TO 1st INTERFACE (NOTE 1) 400 to 533 FEET
		3=OFF 4=OFF 5=OFF	SPAN DISTANCE TO 1st INTERFACE (NOTE 1) 534 to 655 FEET
(NOTE 3) 6=OFF 7=ON	HOST SDI END LCI CONNECTS WITH P2 TO SDI PORT AND WITH P3 TO THE NEXT LCI IN THE DAISY-CHAIN	3=ON 4=ON 5=OFF	TO SET E1 FOR ALL DISTANCES (NOTE 4)
6=ON 7=ON	LCI CONNECTS TO TWO OTHER LCIs IN THE DAISY-CHAIN	6=OFF 7=ON 7=OFF 8=OFF 8=ON	NOT USED D4 (T1 FRAMING) ESF (T1 FRAMING) T1 INTERFACE E1 INTERFACE
6=OFF	NOT USED		

Note 1: SW1 switch positions 3, 4, and 5 specify the distance of each NT7R51AA Local Carrier Interface card to the first signal regenarator, such as a DNI, a repeater, a CSU (T1), or an LTU (E1).
Note 2: SW11 switch positions 1 through 5 specify the address of each NT7R51AA Local Carrier Interface card in a daisy-chain configuration of multiple LCI cards. To match the superloop number assignment, each unit increment from 0 to 31 is actually multiplied by 4 to make it 0, 4, 8,..., 124.
Note 3: SW11 switch positions 6 and 7 specify the connections of each NT7R51AA LocalCarrier Interface card in a daisy-chain using the NT7R67DA External Maintenance cable. The P2 connector on this cable connects towards the host (SDI port) and the P3 connector connects toward the terminal in a daisy-chain configuration (Refer to Figure 11 in the NTP). When only one LCI is installed, the P2 connector connects to the SDI port and the P3 connector connects to the MMI terminal.
Note 4: For switches SW 2, SW5, and SW8, all four switch positions must be set to ON for an E1 carrier link with coaxial cable to set the impedance to 75 OHM.

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Table 11 lists all possible addresses for an NT7R51 Local Carrier Interface card, which are selected on the card with switch SW11 switch positions 1 through 5 (refer to Figure 9 for the SW11 switch position). The address is usedtoaddressaspecificLocalCarrierInterfacecardinadaisy-chainconfiguration.

Table 11
NT7R51 Local Carrier Interface card maintenance daisy-chain address

LCI Address	SW11 Positions 1–5 (1 = ON, 0 = OFF)				
	1 (bin 16)	**2** (bin 8)	**3** (bin 4)	**4** (bin 2)	**5** (bin 1)
0	0	0	0	0	0
4	0	0	0	0	1
8	0	0	0	1	0
12	0	0	0	1	1
16	0	0	1	0	0
20	0	0	1	0	1
24	0	0	1	1	0
28	0	0	1	1	1
32	0	1	0	0	0
36	0	1	0	0	1
40	0	1	0	1	0
44	0	1	0	1	1
48	0	1	1	0	0
52	0	1	1	0	1
56	0	1	1	1	0
60	0	1	1	1	1
64	1	0	0	0	0
68	1	0	0	0	1
72	1	0	0	1	0
76	1	0	0	1	1
80	1	0	1	0	0
84	1	0	1	0	1
88	1	0	1	1	0
92	1	0	1	1	1
96	1	1	0	0	0
100	1	1	0	0	1
104	1	1	0	1	0
108	1	1	0	1	1
112	1	1	1	0	0
116	1	1	1	0	1
120	1	1	1	1	0
124	1	1	1	1	1

Note: For SUPC 0-124 the Local Carrier Interface card MMI address (SW 11, POS 1-5) should match the superloop number. For SUPC 128-156, where the Local Carrier Interface card is installed in Network Group 4, the Local Carrier Interface card address cannot match the superloop number but the address must be unique within the MMI maintenance daisy-chain. Document on the LCI Connection Record card any Local Carrier Interface card MMI address that does not match the SUPC superloop number.

Installing the Local Carrier Interface cable assemblies

The Local Carrier Interface card has two connectors located on the faceplate.These connectors provide:

— connection to the NT7R58AA Maintenance Panel assembly for daisy-chaining the Local Carrier Interface cards and the system monitor

— connection to the NT7R57AA Carrier Panel assembly for the carrier links

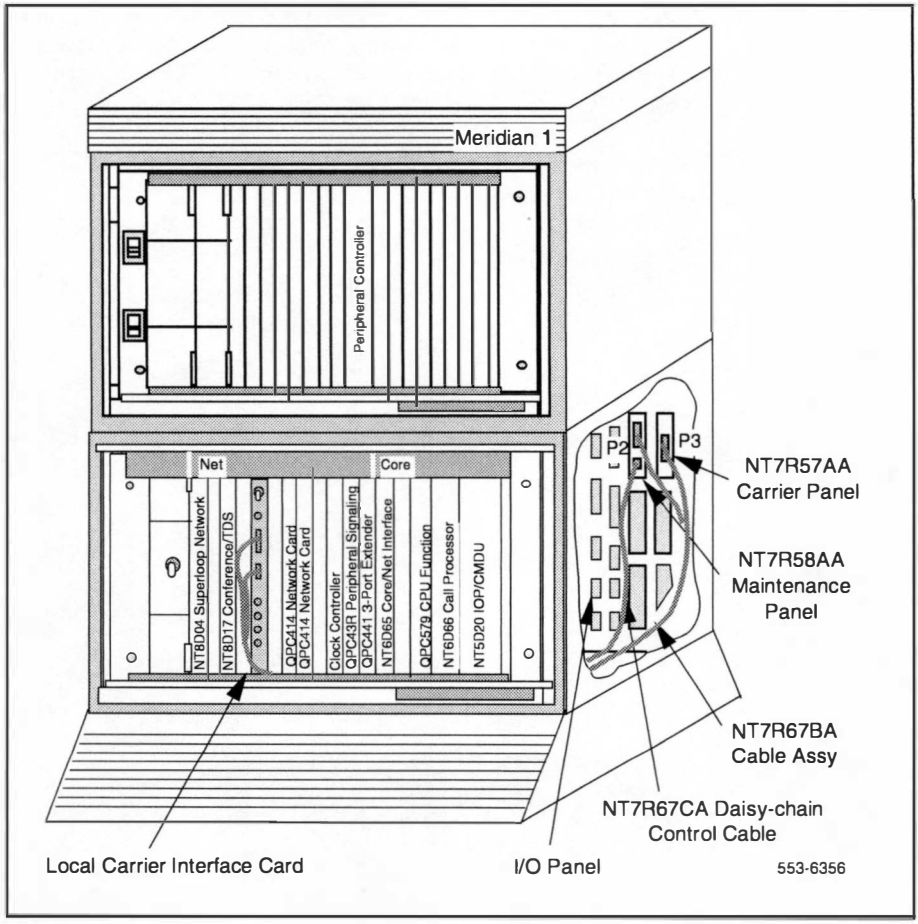
A DB-9 female connector on the faceplate of the NT7R51 Local Carrier Interface card connects to the NT7R58AA Maintenance Panel when more than one Local Carrier Interface card is equipped in the system. This allows daisy-chaining of these Local Carrier Interface cards to provide access to any of the Local Carrier Interface cards using the local MMI terminal at Meridian 1 SDI port as Host.

A DB-25 connector on the Local Carrier Interface card faceplate connects the Local Carrier Interface card to the NT7R57AA Carrier Panel assembly for connection to the local system monitor and the carrier links. The carrier connectors on the NT7R57AA Carrier Panel assembly are 8-pin modular jacks, which connect directly to the carrier link 8-pin modular plugs. It also connects to the NT7R58AA Maintenance Panel assembly to provide the SDI port and the MMI terminal connections. If an E1 carrier link is a coaxial cable terminated with BNC connectors, the NT7R67EA Coaxial Interface Adapter cable (8-pin modular plug to BNC) is used to connect the 8-pin modular jacks at the NT7R57AA Carrier Panel assembly to the BNC carrier link connectors. Also refer to Figure 9 and Figure 15 to set SW1, SW2, SW5, and SW8 for E1 operation and carrier impedance of 75 Ohm.

Note: For multiple Local Carrier Interface cards connected in a daisy-chain, it may not always be possible to find empty network card slots and or suitable I/O panel connector cutouts to accommodate two or more Local Carrier Interface cards. In that case, you may have to use suitable network card slots in a different module or column. If the cable assemblies are not long enough to span between the faceplates and the I/O panels, you may have to use extension cables that are used for this purpose in the NT and XT systems. Refer to Figure 14 "Local Carrier Interface card faceplate cable connections in NT or XT system" on page 105.

Figure 10 shows a Meridian 1 option 51C example with the Local Carrier Interface card and faceplate cable already installed to the NT7R57AA Carrier and NT7R58AA Maintenance Panel assemblies.

Figure 10
Local Carrier Interface card faceplate cable connections in Meridian 1



Installing the NT7R67BA Local Carrier/Monitor Cable Assembly into a module

Before you can plug the NT7R67BA Local Carrier/Monitor Cable Assembly P1 connector into the faceplate DB-25 female connector, install the NT7R57AA Carrier Panel and the NT7R58AA Maintenance Panel assemblies. These assemblies are installed into the empty connector slots on the I/O panel at the rear of the network module where the NT7R51 Local Carrier Interface card(s) is installed. Refer to "Network Module I/O Panel connector cutouts selection" on page 73 recommendations.

> ***Note:*** The NT7R57AA Carrier and the NT7R58AA Maintenance Panel assemblies together with the NT7R67HA cable are integral parts of the NT7R67BA Local Carrier/Monitor Cable Assembly. To assists you in connecting the cable assemblies, refer to Appendix C, Figure 27.

To install the NT7R57AA Carrier and the NT7R58AA Maintenance Panel assemblies and to plug the cable P1 connector into the faceplate connector:

1 Remove the back panel at the rear of the module to access the I/O panel connector slots and later to route the NT7R67HA cable P1 connector to the front of the module.

2 Identify a pair of empty connector cutouts that are the appropriate size for the panel assemblies mounting holes. These cutouts must be vertically or horizontally adjacent on the same I/O panel.

3 From the rear of the module, route the DB-25 female P1 connector of the NT7R67BA cable assembly through the module's cable channel to the front of the module and ensure that the cable connectors with attached panel assemblies remain at the rear of the module next to the module's I/O panel connector cutouts.

4 Install the NT7R57AA Carrier Panel assembly already connected to the P3 DB-15 HD female connector of the NT7R67BA cable assembly. Mount it into the selected I/O panel connector cutout so that the 8-pin modular jack tabs are to the left. Refer to Figure 11 "System monitor, local MMI terminal, and carrier links cable connections" on page 89 for connector orientation. Fasten the panel to the cutout by using the screw at the top of the cutout.

5 Install the NT7R58AA Maintenance Panel assembly already connected to the P2 DB-15 HD male connector of the NT7R67BA cable assembly. Mount it into the selected I/O panel connector cutout by using the screw at the top of the cutout.

6 Plug the DB-25 male P1 connector of the NT7R67BA cable assembly into the DB-25 female connector located on the faceplate of the NT7R51 Local Carrier Interface card.

Installing the NT7R67CA Local daisy-chain cable

This cable is installed only when multiple NT7R51 Local Carrier Interface cards are equipped and are connected in a daisy-chain.The daisy-chain configuration provides an easy access to each Local Carrier Interface card from the local MMI terminal and allows the remote MMI terminal access to the Meridian 1 SDI port as host.To install this cable between the Local Carrier Interface card and the NT7R58AA Maintenance Panel, refer to Appendix C, Figure 28 and follow these steps:

1 Pull the NT7R67CA Daisy-chain Cable assembly P1 connector through the cable channel to the front of the module.

2 Plug the DB-9 male P1 connector of the NT7R67CA cable assembly into the DB-9 female connector located on the faceplate of the Local Carrier Interface card.

3 Plug the DB-9 male P2 connector at the other end of the NT7R67CA cable assembly into the DB-9 female connector on the NT7R58AA Maintenance Panel.

Installing SDI and local MMI terminal cables

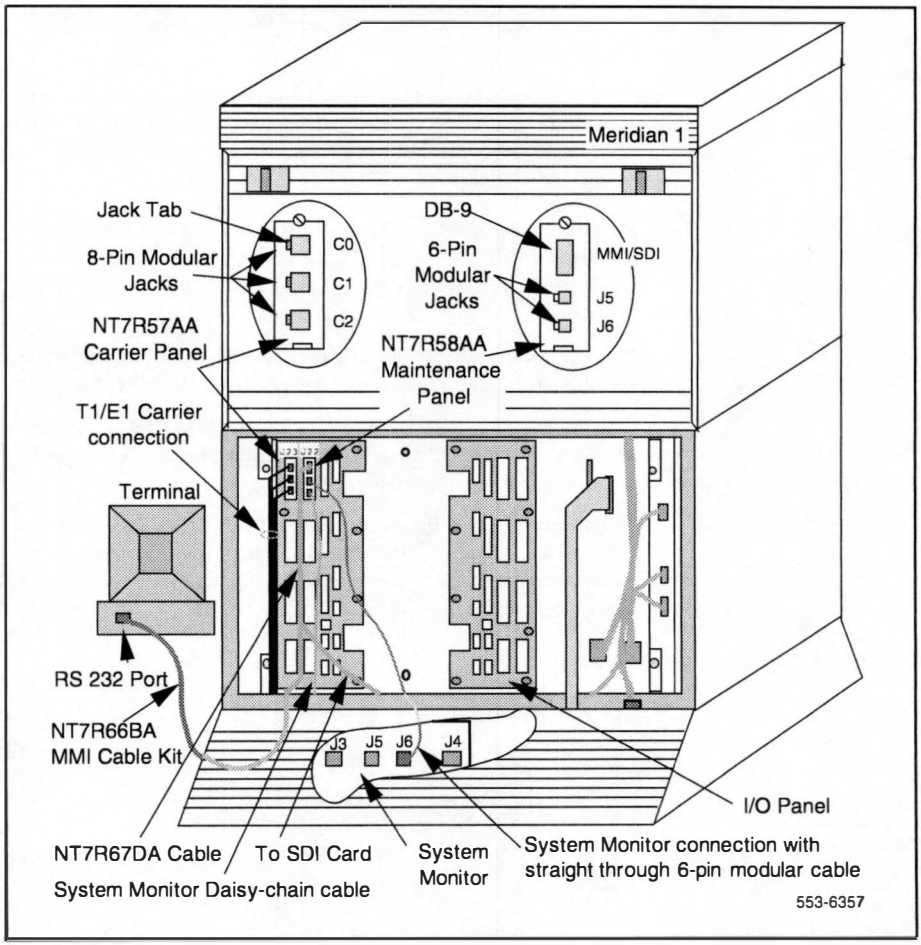
The NT7R67DA External Maintenance Cable Assembly connects the SDI card and the TTY terminal to the DB-9 connector on the NT7R58AA Maintenance Panel assembly located at the rear of the module that houses the NT7R51 Local Carrier Interface card.

For a single Local Carrier Interface card equipped in the Meridian 1 system the P3 DB-9 male DCE connector on the NT7R67DA cable assembly is used to connect to the local MMI terminal and the P2 DB-9 female DTE connector is used to connect to an SDI port on an SDI card, which allows the MMI terminal to access the Meridian 1 system as a host. Refer to Figure 11 and Appendix C, Figure 27.

For multiple Local Carrier Interface cards, refer to Figure 12 on page 96 and Appendix C, Figure 28 that shows how to connect multiple Local Carrier Interface cards to multiple I/O panel assemblies to provide MMI and SDI connections for all Local Carrier Interface cards. To facilitate equipment maintenance, follow the same order as for the system monitor daisy-chain in descending order from the MMI terminal to the SDI port.

Figure 11 shows the NT7R57AA Carrier Panel and NT7R58AA Maintenance Panel assemblies with the system monitor, the SDI/TTY, and the carrier connections. The NT7R58AA Maintenance panel assembly connector is used to connect the SDI port and the local MM1 terminal. The NT7R57AA Carrier panel assembly is used to connect the three carriers.

Figure 11
System monitor, local MMI terminal, and carrier links cable connections



Connecting a single Local Carrier Interface card to the MMI terminal

1 To connect a single NT7R51 Local Carrier Interface card to the MMI terminal:

Note: Appendix C provides connection diagrams (Figure 27) and pin assignment information for all external connectors that connect to the SDI port, the MMI terminal, the system monitor card, the external alarms, and the carrier links.

- Plug the DB-9 male P1 connector at the common end of the NT7R67DA Local External Maintenance Cable assembly into the DB-9 female connector on the NT7R58AA Maintenance Panel assembly.
- Plug the DB-9 male P3 connector of the NT7R67DA cable assembly into the DB-9 female connector of the NT7R66BA MMI Cable.
- Plug the DB-25 male end of the NT7R66BA MMI Cable into the MMI terminal RS-232 connector. If you have to change the gender at the terminal, use the appropriate compact gender changer.
- To connect P3 DB-9 male connector of the NT7R67DA Local External Maintenance Cable directly to the DB-9 male RS-232 serial communication port of a laptop computer, use a NT7R66BA MMI Cable and the appropriate compact adapter.

2 MMI terminal connection using a modem:

- If you need a modem to connect a distant MMI terminal to the MMI port on the Meridian 1 I/O panel, plug the DB-9 female connector of the NT7R66BA MMI Cable into the P3 DB-9 male connector of the NT7R67DA cable.
- Plug the DB-25 male connector of the NT7R66BA MMI Cable into a DB-25F/DB-25M nullmodem.
- Connect the nullmodem DB-25 male connector to the modem DB-25 female connector. Use the appropriate gender changer, if required.

3 MMI terminal connection using an A/B switch box:

- Connect the P3 of the NT7R67DA Local External Maintenance Cable assembly DB-9 male connector into the DB-9 female connector of the NT7R66BA MMI Cable.
- Plug the DB-25 male and of the NT7R66BA MMI Cable into the A/B switch box DB-25 female C connector.
- From the switch box, you can connect a local MMI terminal directly to the A position on the switch box using a standard DB-25M/DB-25M straight-through cable.
- You can also connect a distant MMI terminal over a standard DB-25M/DB-25M straight-through cable, a nullmodem, and a modem to the switch box B position.

4 Terminal/Modem connections over the MSDL Single Terminal Access:

- To avoid using the A/B switch box, you can use three ports on the MSDL card.
- Connect one MSDL port to the Meridian 1 local MMI terminal
- Connect the second MSDL port to a modem.

- Connect the third MSDL port to the P3 DB-9 male connector of the NT7R67DA Local External Maintenance Cable assembly by using the NT7R66BA MMI Cable.

Connecting a single Local Carrier Interface card to the SDI card

Refer to Appendix C and Figure 27 to see the SDI connection diagram.

1 To connect a single NT7R51 Local Carrier Interface card to the QPC 841 or other SDI cards:

- Route the DB-9 female P2 connector of the NT7R67DA cable assembly to an available SDI port on an SDI card.
- Plug the DB-9 male connector of the NT8D93AJ XSDI I/O cable into the DB-9 female SDI connector on the I/O panel.
- Plug the DB-25 male connector of the NT8D93AJ XSDI I/O cable into the DB-25 female connector on the NT7R66AA SDI Cable Kit.
- Plug the DB-9 male connector of the NT7R66AA SDI Cable Kit into the DB-9 female connector into the NT7R67DA cable P2 connector.

2 To connect other SDI cards:

- Route and install the DB-9 female P2 connector of the NT7R67DA cable assembly to an available SDI port on an SDI card.
- Plug the DB-25 male connector of the NT7R66AA SDI Cable Kit to connect the DB-25 female SDI connector at the I/O panel. (The DB-25F/DB-25F adapter is not used).
- Plug the DB-9 male connector on the NT7R66AA SDI Cable Kit into the P2 connector on the NT7R67DA cable.

To test the MMI and Host SDI login, refer to "MMI mode" on page 151 and "Host SDI mode" on page 153 for login instructions.

Note: For additional information about types of SDI cards, their SDI ports, and special cables required to connect these ports, refer to *Meridian 1 Serial Data Interface Cards: Description* (553-3001-107).

Connecting multiple Local Carrier Interface cards to the MMI terminal

Make sure that all the NT7R51 Local Carrier Interface cards are properly configured for the daisy-chain card addressing as shown in Figure 9 "Local Carrier Interface card DIP-switch positions and function" on page 80 and Appendix C, Figure 28.

> ***Note:*** For maintenance convenience, use the daisy-chain addressing in descending order from the MMI terminal side to the host SDI side.

Make sure the NT7R67CA Local Daisy-chain Cable Assembly is installed for all Local Carrier Interface cards in the daisy-chain. Refer to "Installing the NT7R67CA Local daisy-chain cable" on page 86.

1 To connect multiple NT7R51 Local Carrier Interface cards in a daisy-chain configuration and to the MMI terminal, connect the cables as shown in Figure 12 and Appendix C, Figure 28:

- Plug the DB-9 male P1 connector at the common end of the NT7R67DA cable into the DB-9 female connector on the NT7R58AA Maintenance Panel assembly that corresponds to Local Carrier Interface card #1.
- Install the NT7R67DA cable assembly #2, as in step 1, for the Local Carrier Interface card #2.
- Connect the DB-9 male P3 connector from the cable in position #1 with the DB-9 female P2 connector of the NT7R67DA cable assembly in position #2.
- Install the NT7R67DA cable assembly #3, as in step 1, for the Local Carrier Interface card #3.
- Connect the DB-9 male P3 connector from the cable in position #2 with the DB-9 female P2 connector of the NT7R67DA cable assembly in position #3.
- Plug the DB-9 male P3 connector of the NT7R67DA cable assembly in position #3 into the DB-9 female connector of the NT7R66BA MMI Cable.

- Plug the DB-25 male end of the NT7R66BA MMI Cable into the DB-25 female connector of the MMI terminal RS-232 connector. If you have to change the gender at the terminal, use the appropriate compact gender changer.

2 MMI terminal connection using a modem:

- If you need a modem to connect a distant MMI terminal to the MMI port on the Meridian 1 I/O panel, plug the DB-9 female connector of the NT7R66BA MMI Cable into the P3 DB-9 male connector of the NT7R67DA cable.
- Plug the DB-25 male end of the NT7R66BA MMI Cable into a DB-25F/DB-25M nullmodem.
- Connect the nullmodem DB-25 male connector to the modem DB-25 female connector.

3 MMI terminal connection using an A/B switch box:

- Connect the P3 of the NT7R67DA Local External Maintenance Cable assembly DB-9 male connector into the DB-9 female connector of the NT7R66BA MMI Cable.
- Plug the DB-25 male and of the NT7R66BA MMI Cable into the A/B switch box DB-25 female C connector.
- From the switch box, you can connect a local MMI terminal directly to the A position on the switch box using a standard DB-25M/DB-25M straight-through cable.
- You can also connect a distant MMI terminal over a standard DB-25M/DB-25M straight-through cable, a nullmodem, and a modem to the switch box B position.

4 Terminal/Modem connections over the MSDL Single Terminal Access:

- To avoid using the A/B switch box, you can use three ports on the MSDL card.
- Connect one MSDL port to the Meridian 1 local MMI terminal.
- Connect the second MSDL port to a modem.

- Connect the third MSDL port to the P3 DB-9 male connector of the NT7R67DA Local External Maintenance Cable assembly by using the NT7R66BA MMI Cable.

Connecting multiple Local Carrier Interface cards to the SDI card

Refer to Appendix C, Figure 28 to see the SDI connection diagram.

1 To connect a single NT7R51 Local Carrier Interface card to the QPC 841 or other SDI cards:

- Route the DB-9 female P2 connector of the NT7R67DA cable assembly of the Local Carrier Interface card #1 to an available SDI port on an SDI card.
- Plug the DB-9 male connector of the NT8D93AJ XSDI I/O cable into the DB-9 female SDI connector on the I/O panel.
- Plug the DB-25 male connector of the NT8D93AJ XSDI I/O cable into the DB-25 female connector on the NT7R66AA SDI Cable Kit.
- Plug the DB-9 male connector of the NT7R66AA SDI Cable Kit into the DB-9 female connector into the NT7R67DA cable P2 connector.

2 To connect other SDI cards:

- Route and install the DB-9 female P2 connector of the NT7R67DA cable assembly of the Local Carrier Interface card #1 to an available SDI port on an SDI card.
- Plug the DB-25 male connector of the NT7R66AA SDI Cable Kit to connect the DB-25 female SDI connector at the I/O panel. (The DB-25F/DB-25F adapter is not used).
- Plug the DB-9 male connector on the NT7R66AA SDI Cable Kit into the P2 connector on the NT7R67DA cable.

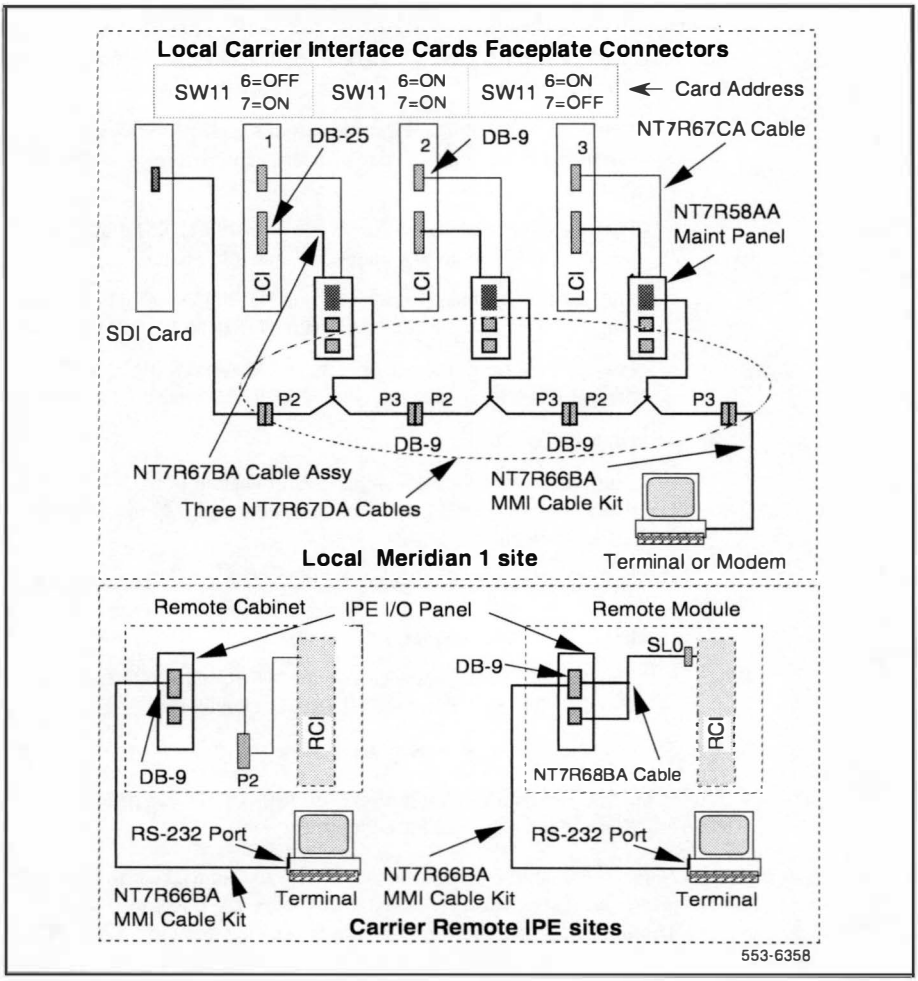
3 Secure cables with tie-wraps as appropriate.

To test the MMI and Host SDI login, refer to "MMI mode" on page 151 and "Host SDI mode" on page 153 for login instructions.

Note: For additional information about types of SDI cards, their SDI ports, and special cables required to connect these ports, refer to *Meridian 1 Serial Data Interface Cards: Description* (553-3001-107).

Figure 12 shows daisy-chaining of multiple Local Carrier Interface cards to allow sharing of an SDI port and a terminal or TTY.

Figure 12
Daisy-chaining multiple Local Carrier Interface cards



Connecting the system monitor cables

The NT7R58AA Maintenance Panel assembly provides two 6-pin modular jacks to connect to the system monitor located in the pedestal and one DB-9 SDI/TTY connector. The 6-pin modular jack J5 is used to connect to the system monitor J6 jack in the pedestal, as shown in Figure 11, and the J6 jack on the NT7R58AAMaintenance Panel is used to connect to a slave system monitor daisy-chain as shown in Figure 12.

In the local Meridian 1 column, the pedestal contains a master system monitor that monitors system alarms. Alarms from a Carrier Remote IPE site are reported over the carrier link and the Local Carrier Interface card to the Meridian 1 master system monitor and from there to the CPU. The CPU sends alarm messages to the system terminal or TTY identifying the problem.

Connecting a single Local Carrier Interface card to the system monitor

To connect the system monitor cable from the NT7R58AA Maintenance Panel assembly to the system monitor in the same column, refer to Figure 11, Appendix C, Figure 31, and perform these steps:

1 Verify existing system monitor daisy-chain first by executing the **STAT XSM** command in LD 37.

2 Determine the system monitor addresses for new Carrier Remote IPE column or wall-mount cabinet.

3 Set master system monitor slave polling address range to cover the new system monitor addresses.

4 Set the Remote Carrier Interface card (SW11 positions 1-5) for the new system monitor address.

5 Connect the system monitor daisy-chain to include new Local Carrier Interface cards by following instructions in steps 6 and 7.

6 Plug the 6-pin modular plug at one end of the NT8D46AL cable into the 6-pin modular jack J5 on the NT7R58AA Maintenance Panel assembly to provide an RS-422 interface to the system monitor.

7 Plug the other end of the NT8D46AL cable 6-pin modular plug into the J6 jack on the next system monitor in the direction of the master system monitor.

8 Plug the next NT8D46AL cable jack into the J6 of the NT7R58AA Maintenance Panel assembly.

9 Plug the other jack of the NT8D46AL cable into the J5 of the next slave system monitor in the direction away from the master system monitor.

10 Test the system monitor daisy-chain by executing the STAT XSM command in LD 37 and ensure that every local and remote system monitor responds to the master system monitor after the remote site is properly installed and configured.

Note: If Meridian 1 with the Carrier Remote IPE is shipped to a site, steps 6 and 7 are completed in the factory.

Connecting multiple Local Carrier Interface cards to the system monitor

Connect the Local Carrier Interface cards for system monitor daisy-chain in the same sequence as you daisy-chained the maintenance cables for the local MMI terminal and the Meridian 1 host SDI access for multiple Local Carrier Interface cards.

To daisy-chain the system monitor cables to multiple columns and multiple NT7R51 Local Carrier Interface cards, refer to Figure 13, Appendix C, Figure 31, and perform these steps:

1 Starting from the top of Figure 13, plug the NT8D46AL cable 6-pin modular plug from one NT7R58AA Maintenance Panel assembly 6-pin modular jack J6 into the 6-pin modular jack J5 on the next NT7R58AA Maintenance Panel assembly.

Note: Each NT7R58AA Maintenance Panel assembly belongs to a different NT7R51 Local Carrier Interface card.

2 Repeat step 1 for all NT7R58AA Maintenance Panel assemblies.

3 Connect J5 modular jack of the top NT7R58AA Maintenance Panel assembly in Figure 13 to J6 modular jack of the next system monitor towards master system monitor using the NT8D46AL modular cable.

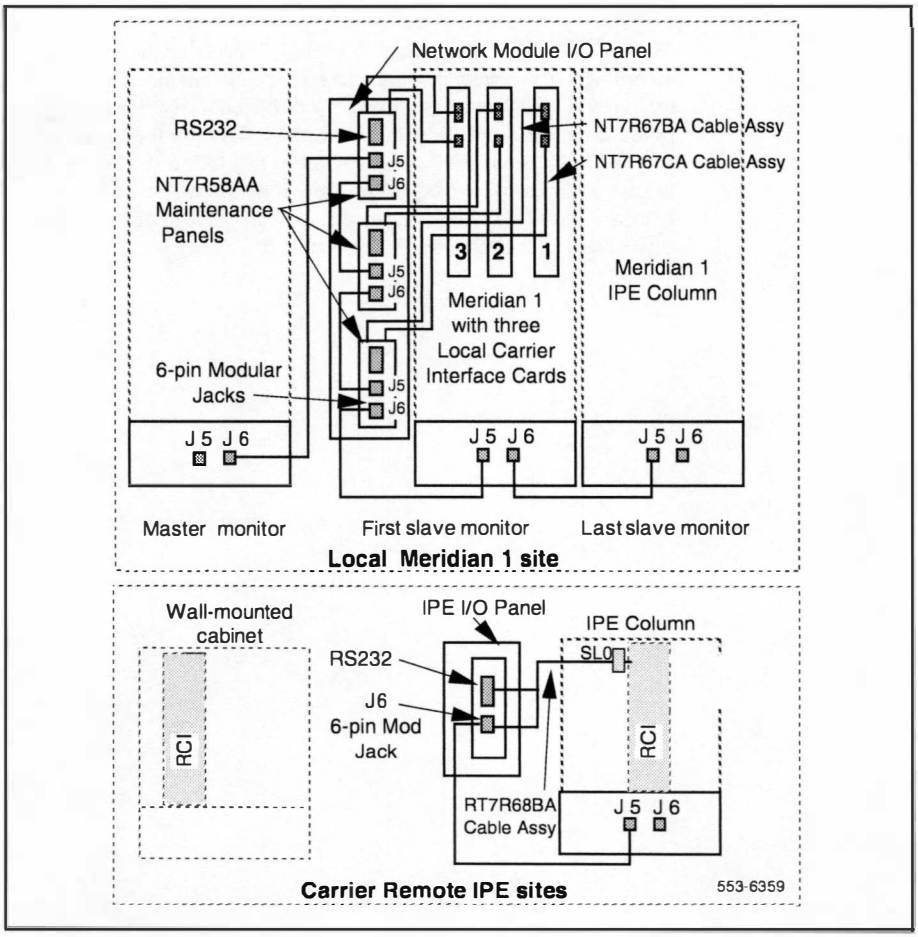
4 Connect J6 modular jack in the bottom NT7R58AA Maintenance Panel assembly to the J5 modular jack of the next slave system monitor away from the master system monitor using the NT8D46AL cable.

5 Connect J6 modular jack of the slave system monitor to the J5 modular jack of the next slave system monitor outbound (away) from the master system monitor using the NT8D46AL cable.

Note: The columns do not have to be daisy-chained in the sequence according to the system monitor address. The system monitor daisy-chain is broken when a Local Carrier Interface card is unplugged from the network card slot. This will cause PWR error messages for polling failure on all slave system monitors that follow the removed Local Carrier Interface card in the chain. If possible, Local Carrier Interface cards should be connected at the end of the system monitor daisy-chain after all the local slave system monitors.

Figure 13 shows system monitor daisy-chain connections at Meridian 1 and Carrier Remote IPE sites. The alarm information is sent over the carrier link from the Remote Carrier IPE to the Meridian 1 CPU.

Figure 13
System monitor connections at Meridian 1 and the Carrier Remote IPE



Connecting the carrier link to the Meridian 1

T1 or E1 carrier links are connected to the NT7R57AA Carrier Panel assembly connectors at the rear of the module housing the Local Carrier Interface card. Carrier links are routed from the telco demarcation point to the Meridian 1 column for connection to the NT7R57AA Carrier Panel assembly containing three 8-pin modular jacks, as shown in Figure 11 on page 89.

Note 1: Before connecting the carrier link to the system, the connection between the telco demarcation point such as CSU, should have been completed using the NT7R87AA T1 CSU Cable Kit.

Note 2: To connect an E1 carrier terminated with BNC connectors, use the NT7R67EA Coaxial Interface Adapter Cable to connect the 8-pin modular jacks at the I/O panel to the BNC connector on each E1 carrier link coming from the telco demarcation point. Also refer to Figure 9 and Figure 15 to set SW1, SW2, SW5, and SW8 for E1 operation and carrier impedance of 75 Ohm.

To connect the carrier link to the network I/O panel at the local Meridian 1 site:

1. Route carrier links to the rear of the Meridian 1 column housing the Local Carrier Interface card.
2. Identify carrier 0, 1, and 2 connectors and the corresponding NT7R57AA Carrier Panel assembly connectors.
3. Plug each carrier cable 8-pin modular plug into the corresponding NT7R57AA Carrier Panel assembly 8-pin modular jack for each T1 carrier link.
4. Record the telco carrier circuit ID for each carrier link (link 0, 1, and 2).

   Note: These carrier circuit IDs will be used at the remote site to identify the links that corresponds to carrier 0, 1, and 2 at the local site. This will prevent mismatch of carrier links between the Local Carrier Interface card and the Remote Carrier Interface card. Enter the carrier connection information into the Carrier Remote IPE Connection Record label, refer to Figure 8 on page 76.

5 If an E1 coaxial carrier link is terminated with BNC connectors, use one NT7R67EA Coaxial Interface Adapter cable to connect each 8-pin modular jack on the NT7R57AA Carrier Panel assembly to BNC carrier link connectors.

6 If the NT7R67EA Coaxial Interface Adapter cable is used for each E1 carrier link, identify BNC connectors on each Adapter cable that correspond to the appropriate carrier (carrier 0, carrier 1, and carrier 2) at the NT7R57AA Carrier Panel Assembly 8-pin jack.

7 Connect each NT7R67EA Coaxial Interface Adapter BNC connector to the appropriate BNC connector on the carrier link.

8 Secure the carrier link cables with tie-wraps as appropriate.

Carrier installation into NT and XT systems

To complete the installation of the T1 or E1 carrier interface that links an NT or XT system to the Carrier Remote IPE equipment, you must:

— verify the operation of the system

— make sure the system is Meridian 1 ready

— identify the network card slot and install the Local Carrier Interface card in the system shelf

— install the faceplate cables

— connect the cable to the Meridian 1 host SDI and the MMI terminal ports

— connect the carrier link to the NT7R57AA Carrier Panel assembly

Note: If NT and XT systems have been upgraded using Meridian 1 column, you can use the system monitor in the pedestal to process system alarms received from the Carrier Remote IPE site. Without the system monitor in the pedestal, the system alarms from the Carrier Remote IPE site cannot be processed.

Installing carrier equipment and verifying system operation

The Carrier Remote IPE facilities can be added to existing NT and XT systems running on X11 Release 21 or later. This requires installing the appropriate carrier equipment into the system, installing one or more Carrier Remote IPEs at different remote sites, and linking the system with remote sites using T1 or E1 carriers.

The NT and XT systems have been previously installed and are normally operational. These systems must be Meridian 1 ready and must be operating correctly before they can be equipped with the Carrier Remote IPE feature. To upgrade these systems to X11 Release 21 or higher, refer to *Upgrade System Installation* (553-3001-258).

Installing the Local Carrier Interface card

The following steps show you how and where to install the NT7R51 Local Carrier Interface cards. The card can be installed when the system is powered up and running.

To install these cards:

1 Set the ENB/DIS switch on the NT7R51 Local Carrier Interface card to DIS.

2 Set the DIP switches to specify the carrier type (T1 or E1), the distance to the first repeater/CSU/LTU, the terminal baud rate, the SDI/MMI terminal connection state, and addressing of multiple Local Carrier Interface cards, as shown in Figure 9 on page 80.

Note: The DIP switch setting will depend on the system configuration. Figure 9 shows that carriers are selected for T1 transmission because all the switches from SW 2 through SW10 are pointing towards T1 positions.

3 Pull the Local Carrier Interface card locking devices away from the faceplate. Holding the card by these locking devices, insert it into the card guides of the selected network card slot. Refer to Table 9.

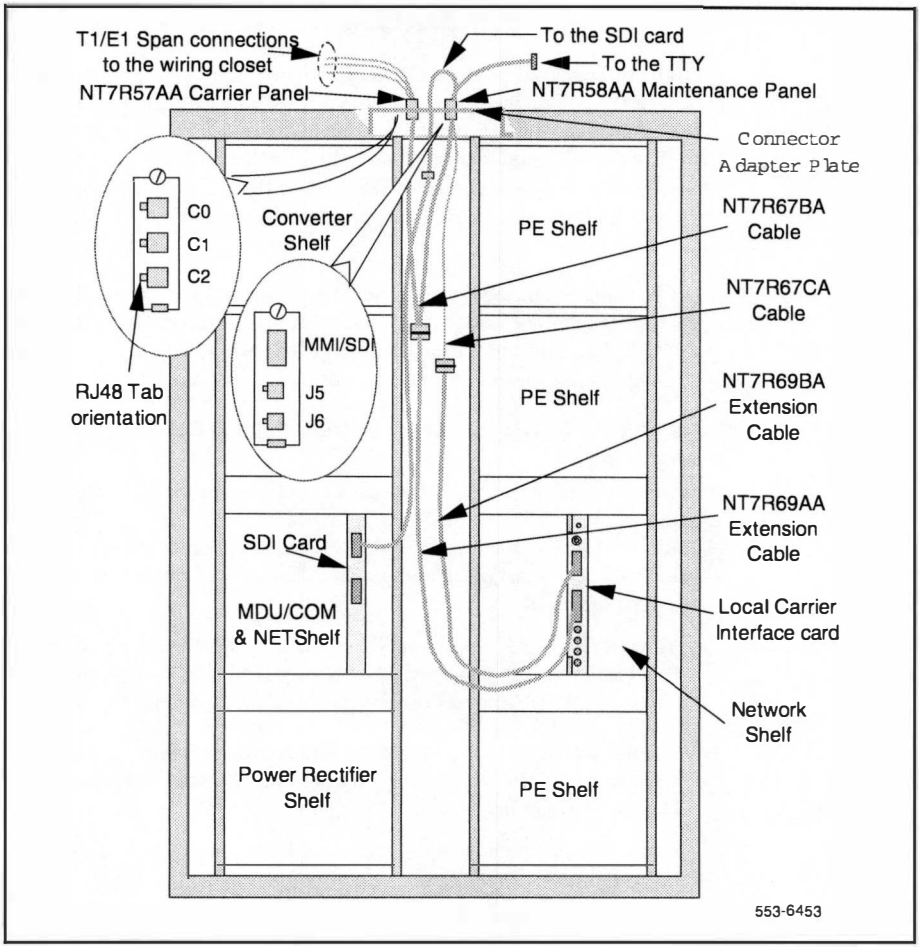
4 Slide the card into the shelf until it engages the backplane connector.

5 Carefully push the locking device levers toward the faceplate to insert the card connector into the backplane connector and lock the card in place.

6 Set the ENB/DIS switch on the Local Carrier Interface card to ENB and observe the LED on the card as it performs self-tests. The LED should blink three times and then stay on until enabled by software. When enabled by software, the LED turns off permanently, if operational. You do not have to enable the card until all the hardware is installed.

Figure 14 shows an NT/XT system with the NT7R51 Local Carrier Interface card and faceplate cables already installed to the NT7R57AA Carrier Panel and NT7R58AA Maintenance Panel assemblies at the top of the cabinet.

Figure 14
Local Carrier Interface card faceplate cable connections in NT or XT system



Installing Local Carrier Interface faceplate cables

The Local Carrier Interface card has two connectors located on the faceplate. These connectors provide:

— connection to the NT7R58AA Maintenance Panel assembly for the MMI terminal and the SDI ports

— connection to the NT7R57AA Carrier Panel assembly for the carrier link

A DB-9 connector on the Local Carrier Interface card faceplate connects to the NT7R58AA Maintenance Panel assembly for connection to the local MMI terminal and the SDI ports. From the Maintenance Panel assembly DB-9 female connector, you can connect to the MMI port for the TTY connection and to an SDI port of an SDI card, or you can daisy-chain to other Local Carrier Interface card SDI connectors, as shown in Figure 12 on page 96.

A DB-25 connector on the Local Carrier Interface card faceplate connects the Local Carrier Interface card to the NT7R58AA Maintenance Panel assembly and the NT7R57AA Carrier Panel assembly. The Carrier Panel assembly uses 8-pin modular jacks to connect to the T1 or E1 carrier links.

Installing the NT7R67BA Local Carrier/Monitor Cable Assembly in a cabinet

Before you can connect the NT7R67BA Local Carrier/Monitor Cable Assembly to the NT7R51 Local Carrier Interface card, install the NT7R57AA Carrier Panel and the NT7R58AA Maintenance Panel assemblies. These panel assemblies are installed into the empty connector slots on the I/O panel at the top of the cabinet.

Note: The NT7R57AA Carrier Panel and the NT7R58AA Maintenance Panel assemblies together with the NT7R67HA cable are integral parts of the NT7R67BA Local Carrier/Monitor Cable Assembly.

1 Identify the empty connector cutouts at the top center of the cabinet to be used for the NT7R57AA Carrier Panel and the NT7R58AA Maintenance Panel assemblies installation.

2 Install the appropriate connector housing kit if you cannot find existing empty connector cutouts.

3 If required, install the P0702380 connector housing kit, which mounts at the top of the cabinet for NT and XT systems.

4 Install the NT7R57AA Carrier Panel assembly and the NT7R58AA Maintenance Panel assembly in the connector cutouts by using screws at each end of the selected connector cutout. Remember these panel assemblies are integral parts of the NT7R67BA cable assembly. Install the NT7R57AA Carrier Panel so that the 8-pin modular jack tabs are to the left placing carrier 0 at the top as shown in Figure 14.

5 Install the adapter plate covering 5 adjacent connector slots on top of the connector housing.

Connecting the cables to the faceplate connectors

To connect the NT7R51 Local Carrier Interface card to the MMI port, the SDI port, and the carrier links, refer to Figure 14 and follow these steps:

1 Plug the DB-25 male connector of the NT7R69AA Extension Local Carrier Cable into the DB-25 female connector located on the NT7R51 Local Carrier Interface card faceplate.

2 Plug the DB-25 female connector of the NT7R69AA Extension Local Carrier Cable into the DB-25 male P1 connector of the NT7R67BA Local Carrier/Monitor Cable assembly.

3 Verify that the P2 and P3 connectors of the NT7R67BA Local Carrier/Monitor Cable Assembly are connected to the NT7R57AA Carrier Panel assembly and the NT7R58AA Maintenance Panel assembly, as follows:

- The P3 DB-15 HD female connector is connected to the DB-15 HD male connector of the NT7R57AA Carrier Panel assembly.
- The P2 DB-15 HD male NT7R67BA cable assembly connector is connected to the DB-15 HD female connector of the NT7R58AA Maintenance Panel assembly.

Note: These panel assemblies and the NT7R67HA cable are parts of the NT7R67BA Local Carrier/Monitor Cable Assembly and are normally attached to the cable connectors in the factory. These panels cannot be ordered separately, they have to be ordered as the NT7R67BA cable assembly.

Installing SDI and MMI terminal cables

The NT7R58AA Maintenance Panel assembly provides connectors to connect the NT7R51 Local Carrier Interface card to the MMI terminal and to an SDI port as shown in Figure 12 on page 96.

Connecting a single Local Carrier Interface card to the MMI terminal in the NT or XT cabinet

1 To connect a single NT7R51 Local Carrier Interface card to the MMI terminal:

Note: Refer to Appendix C, Figure 27 for connection diagrams and tables listing pin assignment information for all external connectors that connect to the SDI port, the MMI terminal, the system monitor card, the external alarms, and the carrier links.

- Plug the NT7R69AA Extension cable DB-9 male connector into the DB-9 female connector on the NT7R58AA Maintenance Panel assembly.
- Plug the DB-9 male P1 connector at the common end of the NT7R67DA Local External Maintenance Cable assembly into the NT7R69AA Extension cable DB-9 female connector.
- Plug the DB-9 male P3 connector of the NT7R67DA cable assembly into the DB-9 female connector of the NT7R66BA MMI Cable.
- Plug the DB-25 male end of the NT7R66BA MMI Cable into the MMI terminal RS-232 connector. If you have to change the gender at the terminal, use the appropriate compact gender changer such as a DB-25F/DB-25F gender changer.
- To connect P3 DB-9 female connector of the NT7R67DA Local External Maintenance Cable directly to the DB-9 male RS-232 serial communication port of a laptop computer, see the NT7R66BA MMI Cable and the appropriate compact gender changer.

2 MMI terminal connection using a modem:

- If you need a modem to connect a distant MMI terminal to the MMI port on the NT or XT system I/O housing, plug the DB-9 female connector of the NT7R66BA MMI Cable into the P3 DB-9 male connector of the NT7R67DA cable.
- Plug the DB-25 male end of the NT7R66BA MMI Cable into a DB-25F/DB-25M nullmodem.
- Connect the nullmodem DB-25 male connector to the modem DB-25 female connector.

3 MMI terminal connection using an A/B switch box:

- Connect the P3 of the NT7R67DA Local External Maintenance Cable assembly DB-9 male connector into the DB-9 female connector of the NT7R66BA MMI Cable.
- Plug the DB-25 male and of the NT7R66BA MMI Cable into the A/B switch box DB-25 female C connector.
- From the switch box, you can connect a local MMI terminal directly to the A position on the switch box using a standard DB-25M/DB-25M straight-through cable.
- You can also connect a distant MMI terminal over a standard DB-25M/DB-25M straight-through cable, a nullmodem, and a modem to the switch box B position.

4 Terminal/Modem connections over the MSDL Single Terminal Access:

- To avoid using the A/B switch box, you can use three ports on the MSDL card.
- Connect one MSDL port to the Meridian 1 local MMI terminal
- Connect the second MSDL port to a modem.
- Connect the third MSDL port to the P3 DB-9 male connector of the NT7R67DA Local External Maintenance Cable assembly using the NT7R66BA MMI Cable.

Connecting a single Local Carrier Interface card to the SDI card in the NT or XT cabinet

Refer to Appendix C and Figure 27 to see the SDI connection diagram.

1 To connect a single NT7R51 Local Carrier Interface card to the QPC 841 or other SDI cards:

- Route the DB-9 female P2 connector of the NT7R67DA cable assembly of the Local Carrier Interface card to an available SDI port on an SDI card.
- Plug the DB-9 male connector of the NT8D93AJ XSDI I/O cable into the DB-9 female SDI connector on the I/O panel.
- Plug the DB-25 male connector of the NT8D93AJ XSDI I/O cable into the DB-25 female connector on the NT7R66AA SDI Cable Kit.
- Plug the DB-9 male connector of the NT7R66AA SDI Cable Kit into the DB-9 female connector into the NT7R67DA cable P2 connector.

2 To connect other SDI cards:

- Route and install the DB-9 female P2 connector of the NT7R67DA cable assembly to an available SDI port on an SDI card.
- Plug the DB-25 male connector of the NT7R66AA SDI Cable Kit (do not use the DB-25F/DB-25F adapter) to connect the DB-25 female SDI connector at the I/O panel.
- Plug the DB-9 male connector on the NT7R66AA SDI Cable Kit into the P2 connector on the NT7R67DA cable.

To test the MMI and Host SDI login, refer to "MMI mode" on page 151 and "Host SDI mode" on page 153 for login instructions.

Note: For additional information about types of SDI cards, their SDI ports, and special cables required to connect these ports, refer to *Meridian 1 Serial Data Interface Cards: Description* (553-3001-107).

Connecting multiple Local Carrier Interface cards to the MMI terminal

Make sure that all the NT7R51 Local Carrier Interface cards in the NT or XT system are properly configured for the daisy-chain card addressing as shown in Figure 9 "Local Carrier Interface card DIP-switch positions and function" on page 80 and Appendix C, Figure 28.

Make sure the NT7R67CA Local Daisy-chain Cable Assembly is installed for all Local Carrier Interface cards in the daisy-chain. Refer to "Installing the NT7R67CA Local daisy-chain cable" on page 86.

1 To connect multiple NT7R51 Local Carrier Interface cards in a daisy-chain configuration and to the MMI terminal, connect the cables as shown in Figure 12 and Appendix C, Figure 28:

- Plug an NT7R69AA Extension cable DB-9 male connector into each DB-9 female connector on each NT7R58AA Maintenance Panel assembly belonging to Local Carrier Interface card #1.
- Plug the DB-9 male P1 connector at the NT7R67DA Local External Maintenance Cable assembly #1 into the corresponding NT7R69AA Extension cable DB-9 female connector for Local Carrier Interface card #1.
- Plug the NT7R67DA cable assembly #2 into the NT7R69AA Extension cable DB-9 female connector for Local Carrier Interface card #2.
- Connect the DB-9 male P3 connector from the cable in position #1 with the DB-9 female P2 connector of the NT7R67DA cable assembly in position #2.
- Plug the NT7R67DA cable assembly #3 into the NT7R69AA Extension cable DB-9 female connector for Local Carrier Interface card #3.
- Connect the DB-9 male P3 connector from the cable in position #2 with the DB-9 female P2 connector of the NT7R67DA cable assembly in position #3.
- Plug the DB-9 male P3 connector of the NT7R67DA cable assembly in position #3 into the DB-9 female connector of the 3NT7R66BA MMI Cable.
- Plug the DB-25 male end of the NT7R66BA MMI Cable into the DB-25 female connector of the MMI terminal RS-232 connector. If you have to change the gender at the terminal, use the appropriate compact gender changer.

2 MMI terminal connection using a modem:

- If you need a modem to connect a distant MMI terminal to the MMI port on the Meridian 1 I/O panel, plug the DB-9 female connector of the NT7R66BA MMI Cable into the P3 DB-9 male connector of the NT7R67DA cable.
- Plug the DB-25 male connector of the NT7R66BA MMI Cable into the DB-25 female end of a DB-25F/DB-25M nullmodem.
- Connect the nullmodem DB-25 male connector to the modem DB-25 female connector.

3 MMI terminal connection using an A/B switch box:

- Connect the P3 of the NT7R67DA Local External Maintenance Cable assembly DB-9 male connector into the DB-9 female connector of the NT7R66BA MMI Cable.
- Plug the DB-25 male and of the NT7R66BA MMI Cable into the A/B switch box DB-25 female C connector.
- From the switch box, you can connect a local MMI terminal directly to the A position on the switch box using a standard DB-25M/DB-25M straight-through cable.
- You can also connect a distant MMI terminal over a standard DB-25M/DB-25M straight-through cable, a nullmodem, and a modem to the switch box B position.

4 Terminal/Modem connections over the MSDL Single Terminal Access:

- To avoid using the A/B switch box, you can use three ports on the MSDL card.
- Connect one MSDL port to the Meridian 1 local MMI terminal
- Connect the second MSDL port to a modem.

- Connect the third MSDL port to the P3 DB-9 male connector of the NT7R67DA Local External Maintenance Cable assembly by using the NT7R66BA MMI Cable.

Connecting multiple Local Carrier Interface cards to the SDI card

Refer to Appendix C, Figure 28 to see the SDI connection diagram.

1 To connect a single NT7R51 Local Carrier Interface card to the QPC 841 or other SDI cards:

- Route the DB-9 female P2 connector of the NT7R67DA cable assembly of the Local Carrier Interface card #1to an available SDI port on an SDI card.
- Plug the DB-9 male connector of the NT8D93AJ XSDI I/O cable into the DB-9 female SDI connector on the I/O panel.
- Plug the DB-25 male connector of the NT8D93AJ XSDI I/O cable into the DB-25 female connector on the NT7R66AA SDI Cable Kit.
- Plug the DB-9 male connector of the NT7R66AA SDI Cable Kit into the DB-9 female connector into the NT7R67DA cable P2 connector.

2 To connect other SDI cards:

- Route and install the DB-9 female P2 connector of the NT7R67DA cable assembly of the Local Carrier Interface card #1to an available SDI port on an SDI card.
- Plug the DB-25 male connector of the NT7R66AA SDI Cable Kit to connect the DB-25 female SDI connector at the I/O panel. (The DB-25F/DB-25F adapter is not used).
- Plug the DB-9 male connector on the NT7R66AA SDI Cable Kit into the P2 connector on the NT7R67DA cable.

3 Secure cables with tie-wraps as appropriate.

To test the MMI and Host SDI login, refer to "MMI mode" on page 151 and "Host SDI mode" on page 153 for login instructions.

Note: For additional information about types of SDI cards, their SDI ports, and special cables required to connect these ports, refer to *Meridian 1 Serial Data Interface Cards: Description* (553-3001-107).

Connecting carrier links to the NT/XT system cabinet

The T1 or E1 carrier links are connected to the NT7R57AA Carrier Panel assembly at the top of NT and XT system cabinets. Carrier links are routed from the telco demarcation point to the system cabinet I/O panel containing NT7R57AA Carrier Panel assembly with three 8-pin modular jacks, as shown in Figure 14 on page 105.

Note 1: Before connecting the carrier link to the system, the connection between the telco demarcation point such as CSU, should have been completed using the NT7R87AA T1 CSU Cable Kit.

Note 2: To connect an E1 carrier link terminated with BNC connectors, use the NT7R67EA Coaxial Interface Adapter Cable to connect 8-pin modular jacks at the I/O panel to the BNC connector on each E1 carrier link coming from the telco demarcation point. Also refer to Figure 9 and Figure 15 to set SW1, SW2, SW5, and SW8 for E1 carrier impedance of 75 Ohm.

To connect carrier links to the NT7R57AA Carrier Panel assembly at the local system site:

1 Route the three carrier links to the top of the NT and XT systems cabinets.

2 Identify carrier 0, 1, and 2 connectors and the corresponding NT7R57AA Carrier Panel assembly 8-pin modular jacks.

3 Plug the carrier link cable 8-pin modular plugs into the corresponding NT7R57AA Carrier Panel assembly 8-pin modular jacks for each carrier.

4 Record the telco carrier circuit ID for each carrier link (link 0, 1, and 2).

Note: These carrier circuit IDs will be used at the remote site to identify links that corresponds to carrier 0, 1, and 2 at the local site. This will prevent mismatch of carrier links between the Local Carrier Interface card and the Remote Carrier Interface card. Record the connection information on the "Carrier Remote IPE Connection Record label" on page 76.

5 If an E1 coaxial carrier link is terminated with BNC connectors, use one NT7R67EA Coaxial Interface Adapter cable to connect each 8-pin modular jack on the NT7R57AA Carrier Panel assembly to BNC carrier link connectors.

6 Identify BNC connectors on each NT7R67EA Coaxial Interface Adapter cable that corresponds to the appropriate carrier (carrier 0, carrier 1, and carrier 2) at the NT7R57AA Carrier Panel Assembly 8-pin jack.

7 Connect each NT7R67EA Coaxial Interface Adapter BNC connector to the appropriate BNC connector on the carrier link.

8 Secure all carrier link cables with tie-wraps as appropriate.

Carrier Remote IPE column installation

To complete the installation of the Carrier Remote IPE column equipment, you must:

— install the Carrier Remote IPE column

— install the cards into the IPE module

— install the cable assemblies from the I/O panel to the backplane

— connect carrier links to the carrier panel assembly

— configure the carrier equipment using overlays and MMI commands

Note: All Carrier Remote IPE modules or cabinets are preinstalled in the factory with cards already in their respective card slots. The only exception is the power supply, which is packaged separately and must be installed at the site.

Installing the Carrier Remote IPE column

The column is normally assembled in the factory with cards already installed and the cable already connected between the backplane connector and the I/O panel at the rear of the IPE module.

If the column is not assembled in the factory, you will need to install the Meridian 1 type modular column (floor-standing column) at the remote site. To do this, follow the instructions in *System Installation Procedures* (553-3001-210). It describes how to install the pedestal, the IPE module, and the top cap, and how to connect the power, the internal and external communication cables, and subscriber loops.

To install the Power Fail Transfer Unit (PFTU) to the Carrier Remote IPE column, follow the instructions in *System Installation Procedures* (553-3001-210).

Installing cards into the Remote IPE module

The following steps show you how and where to install the NT7R52 Remote Carrier Interface card and other IPE cards in the Remote IPE module. Although the cards usually are shipped installed from the factory, this document provides step-by-step card installation, which should be followed when additional IPE cards are installed or defective cards are replaced.

To install cards in the Remote IPE Module:

1 Set the DIP switches on the NT7R52 Remote Carrier Interface card to specify the carrier type (T1 or E1), the distance to the first repeater, the MMI terminal baud rate, and the system monitor address. The DIP switch setting will depend on the physical system configuration.

2 Verify that SW1 position 2 is set to **ON** to specify the remote site.

Note: Figure 15 shows the location of the DIP switches and their functions. Switches 2, 3, and 4 determine if carrier 0 is a T1 or an E1 link, switches 4, 6, and 7 determine if carrier 1 is a T1 or an E1 link, and switches 8, 9, and 10 determine if carrier 2 is a T1 of an E1 link. All three carrier links must be of the same type, for example, T1 or E1. DIP switches S 1 and SW11 define parameter listed in the table in Figure 15. Correspondingly, Figure 9 "Local Carrier Interface card DIP-switch positions and function" on page 80, shows the Local Carrier Interface card DIP switches SW1 through SW11 and their functions.
Refer to Figure 9 "Local Carrier Interface card DIP-switch positions and function" on page 80 for DIP switch settings for the Local Carrier Interface card.

3 Determine the system monitor address for each remote site by setting SW11 positions 1-5 on the Remote Carrier Interface card. Before you select the address, you must determine which are the available system monitor addresses, as follows:

- Execute the **STAT XSM** command in **LD 37** to poll all system monitors. Correct any problems.
- Determine available system monitor addresses to be assigned to the Remote IPE module or the wall-mounted Carrier Remote IPE cabinet.
- Set master system monitor slave polling address range to cover the new Carrier Remote IPE system monitor address.
- Set Remote Carrier Interface card **SW 11** positions **1-5** for the new system monitor address.
- Re-connect the system monitor daisy-chain to include new Local Carrier Interface cards.
- Test the system monitor daisy-chain by executing the **STAT XSM** command in **LD 37** to ensure that every local and remote system monitor or Remote Carrier Interface card system monitor emulation in the remote cabinet is responding to the master system monitor.

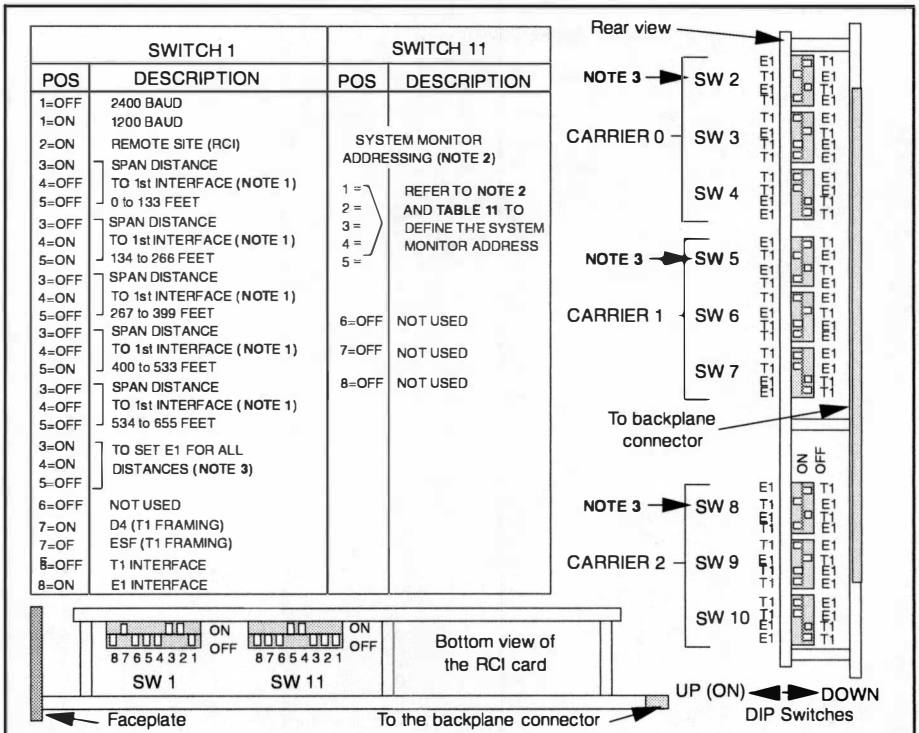
Table 12 lists the default (factory provided switch settings) for the Remote Carrier Interface card. These settings can be used in the majority of applications, however, if different settings are required, you should change the switch settings before installing the Remote Carrier Interface card.

Table 12
Remote Carrier Interface standard (default) switch settings

Switch	Switch positions							
	1	2	3	4	5	6	7	8
SW1	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF
SW11	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
SW2	OFF	ON	OFF	ON	-	-	-	-
SW3	ON	OFF	ON	ON	-	-	-	-
SW4	ON	ON	OFF	OFF	-	-	-	-
SW5	OFF	ON	OFF	ON	-	-	-	-
SW6	ON	OFF	ON	ON	-	-	-	-
SW7	ON	ON	OFF	OFF	-	-	-	-
SW8	OFF	ON	OFF	ON	-	-	-	-
SW9	ON	OFF	ON	ON	-	-	-	-
SW10	ON	ON	OFF	OFF	-	-	-	-

Figure 15 shows the NT7R52AA Remote Carrier Interface card DIP switches. SW2 through SW10 select the carrier characteristic. SW1 and SW11 define repeater distance, baud rate, and system monitor address.

Figure 15
Remote Carrier Interface card DIP-switch locations and functions



Note 1: SW1 switch positions 3, 4, and 5 specify the distance of each NT7R52AA Remote Carrier Interface card to the first signal regenarator, which can be a carrier repeater, a CSU, or an LTU.
Note 2: SW11 switch positions 1 throug 5 specify the system monitor address of each NT7R52AA Remote Carrier Interface card. The system monitor address must be a unique number from 0 to 31. For Carrier Remote IPE module configuration, the address is specified on the System Monitor card in the pedestal and the Remote Carrier Interface card. For the small Carrier Remote IPE cabinet the Remote Carrier Interface card emulates the system monitor address.
Note 3: SW2, SW5, and SW8 all positions set to ON for coaxial (E1) carrier impedance of 75 OHM.

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Table 13 lists system monitor addresses for the Remote Carrier Interface card, which are selected using switch SW11 switch positions 1 through 5. A unique address is selected for each Remote Carrier Interface card. Refer to Figure 15 for the SW11 switch location on the card.

Table 13
NT7R52 Remote Carrier Interface card system monitor address selection

RCI System Monitor Address	SW11 Positions 1–5 (1 = ON, 0 = OFF)				
	1	2	3	4	5
1	0	0	0	0	1
2	0	0	0	1	0
3	0	0	0	1	1
4	0	0	1	0	0
5	0	0	1	0	1
6	0	0	1	1	0
7	0	0	1	1	1
8	0	1	0	0	0
9	0	1	0	0	1
10	0	1	0	1	0
11	0	1	0	1	1
12	0	1	1	0	0
13	0	1	1	0	1
14	0	1	1	1	0
15	0	1	1	1	1
16	1	0	0	0	0
17	1	0	0	0	1
18	1	0	0	1	0
19	1	0	0	1	1
20	1	0	1	0	0
21	1	0	1	0	1
22	1	0	1	1	0
23	1	0	1	1	1
24	1	1	0	0	0
25	1	1	0	0	1
26	1	1	0	1	0
27	1	1	0	1	1
28	1	1	1	0	0
29	1	1	1	0	1
30	1	1	1	1	0
31	1	1	1	1	1

4 Pull the NT7R52AA Remote Carrier Interface card locking devices away from the faceplate. Holding the card by these locking devices, insert it into the card guides in the card slot marked *Cont.*, which is located to the right of slot 7. Make sure to use the card guides immediately to the right of slot 7.

5 Slide the card into the module until it engages the backplane connector.

6 Push the locking device levers towards the faceplate to insert the card connector into the backplane connector and lock the card in place.

7 Observe the LED on the card as it performs self-tests. The LED should blink three times and then stay on until enabled by software. When enabled by software, the LED turns off permanently, if operational.

8 Install IPE cards in slots 0 through 7 and 8 through 15 by pulling the card locking devices away from the faceplate and inserting the card into the card guides of an IPE card slot.

9 Slide the card into the module until it engages the backplane connector and then push the locking device levers toward the faceplate to insert the card connector into the backplane connector and lock the card in place.

10 Repeat steps 7 and 8 for each IPE card.

Installing the backplane cable assemblies

The Remote Carrier Interface card backplane connectors provide access to three carrier links, the system monitor, external alarms, and the MMI maintenance port. The NT7R68AA Remote Carrier/Alarm Cable assembly is routed from the Remote Carrier Interface card lower backplane connector SL1 to the I/O panel connectors that support carrier link and auxiliary or external alarm connections. The NT7R68BA Remote Maintenance Cable assembly connects the upper backplane connector SL0 to the I/O panel connectors that support the system monitor and the SDI/MMI terminal connections.

Installing the NT7R68AA Remote Carrier/Alarm Cable Assembly

The NT7R68AA Remote Carrier/Alarm Cable assembly consists of the NT7R68HA cable, the NT7R59AA Carrier Panel, and NT7R60AA Carrier/Alarm Panel assemblies.

Before you can plug the cables into the IPE module backplane, you must install the NT7R59AA Carrier Panel and NT7R60AA Carrier/Alarm Panel assemblies into the connector cutouts on the I/O panel at the rear of the IPE module, refer to Figure 16 and Appendix C, Figure 29 for details. To install the panel assemblies:

1 Remove the back panel at the rear of the IPE module to be able to access the I/O panel connector cutouts.

2 Identify the empty connector cutouts that are the appropriate size for the panel assemblies. Refer to "Carrier Remote IPE Module I/O panel connector selection" on page 74 for connector cutouts selection recommendation.

3 Install the NT7R59AA Carrier Panel assembly into the recommended connector cutout in the I/O panel. Install it so that 8-pin modular jack tabs are positioned to the left of the connectors, placing carrier 0 at the top of the NT7R59AA Carrier Panel assembly and carrier 1 at the bottom. Tighten the retaining screw.

4 Install the NT7R60AA Carrier/Alarm Panel assembly into the recommended J5 empty connector cutout in the I/O panel. Tighten the retaining screw. This panel contains an 8-pin modular jack for carrier 2 at the bottom and a DB-15 HD female auxiliary alarm (external alarm) connector at the top of the panel assembly.

5 Plug the P1 24-pin block connector of the NT7R68AA Remote Carrier/Alarm Cable assembly into the SL1 connector on the IPE Module's backplane.

Installing the NT7R68BA Remote Maintenance Cable Assembly

The NT7R68BA Remote Maintenance Cable assembly consists of the NT7R68GA cable and NT7R61AA Maintenance Panel assembly.

Before you can plug the cable into the IPE module backplane, you must install the NT7R61AA Maintenance Panel assembly into the connector cutout on the I/O panel at the rear of the IPE module, refer to Figure 16 and Appendix C, Figure 29. To install the panel assembly:

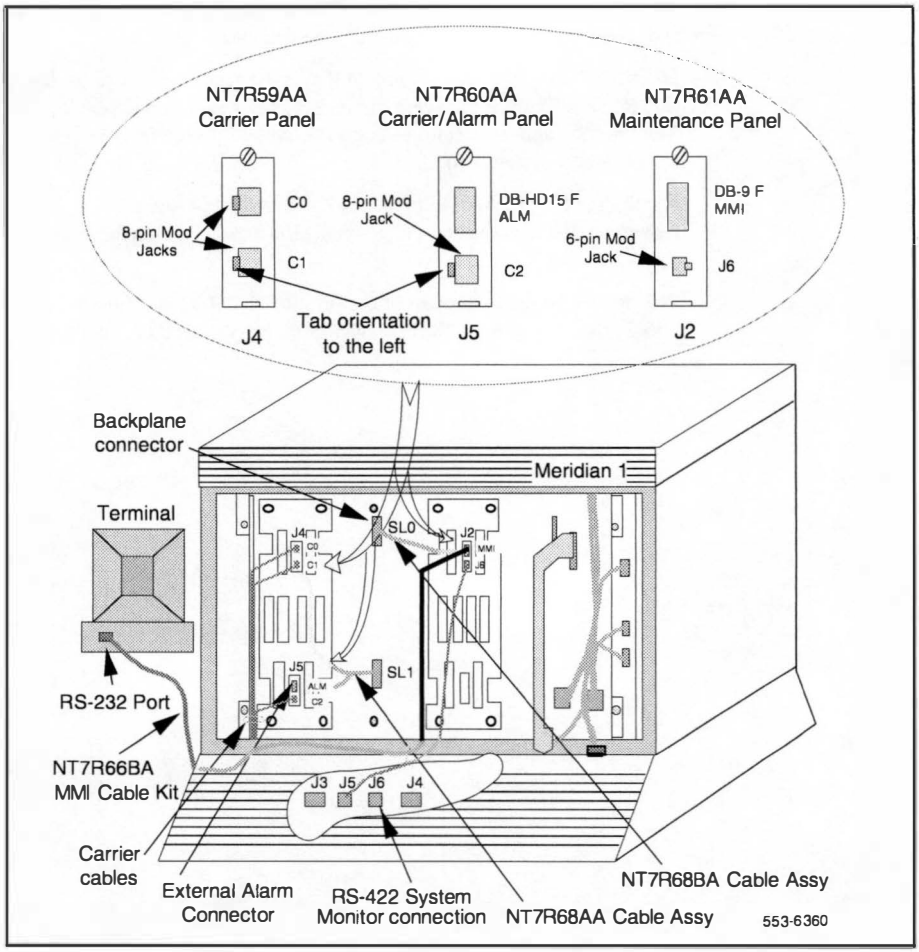
1 Identify the empty connector cutout that is the appropriate size for the NT7R61AA Maintenance Panel assembly. Refer to "Carrier Remote IPE Module I/O panel connector selection" on page 74 or connector cutouts selection recommendation.

2 Install the NT7R61AA Maintenance Panel assembly into the recommended J2 connector cutout on the I/O panel. Tighten the retaining screw.

3 Plug the P1 24-pin connector of the NT7R68BA Remote Maintenance Cable assembly into the SL0 connector on the IPE Module's backplane.

Figure 16 shows the rear of the Carrier Remote IPE module and cables connecting the backplane connectors to the module's I/O panel assembly connectors installed into the recommended connector cutouts.

Figure 16
Backplane to I/O panel connections on the IPE module



Installing system monitor cables

The NT8D46AL system monitor cable is normally installed in the factory and does not have to be installed at the site.

In the remote floor-standing column, the pedestal contains a slave system monitor used to monitor Carrier Remote IPE system alarms. These alarms are reported over the carrier link and the Local Carrier Interface card to the Meridian 1 master system monitor and from there to the CPU. The CPU sends PWR alarm messages to the system maintenance TTY identifying the problem.

Figure 16 shows the system monitor cable connections for a Carrier Remote IPE column. To connect the slave system monitor in the pedestal:

1 Plug the 6-pin modular plug at one end of the NT8D46AL cable into the J6 6-pin modular jack on the IPE module NT7R61AA Remote Maintenance Panel assembly. This cable provides an RS-422 interface to the system monitor.

2 Plug the other end of the NT8D46AL cable 6-pin modular plug into the J5 modular jack on the system monitor in the pedestal.

3 Check the NT8D22 System Monitor factory switch settings for the slave system monitor. Refer to "Option settings" in *Circuit Card: Installation and Testing* (553-3001-211).

Note: Set the system monitor address on the system monitor card in the pedestal to be identical to the system monitor address set on the Remote Carrier Interface card using SW11 switch positions 1 through 5. Set the slave system monitor to the same address that corresponds to the master system monitor at the local site.

4 For multiple Carrier Remote IPE modules on a single pedestal, connect only one Remote Carrier Interface card to the system monitor in the pedestal. However, set the system monitor address on all Remote Carrier Interface cards to be the same as the system monitor address in the pedestal. This will allow you to connect any Remote Carrier Interface card to the system monitor in the pedestal.

Installing remote MMI terminal cables

The cable that has to be installed at the site is the terminal cable connecting the terminal or TTY to the DB-9 female connector on the NT7R61AA Remote Maintenance Panel assembly.

Figure 16 shows the MMI terminal cable connections for a Carrier Remote IPE column. Also, refer to and Appendix C, Figure 29. To connect the MMI terminal:

1 Plug the DB-9 female connector of the NT7R66BA MMI Cable into the MMI DB-9 male connector on the IPE module NT7R61AA Remote Maintenance Panel assembly.

2 Plug the other end of the NT7R66BA MMI Cable DB-25 male connector into the MMI terminal RS-232 connector. If the MMI terminal has a male connector, use a compact gender changer to connect the MMI terminal.

3 If an distant MMI terminal is connected to the MMI connector on the Maintenance Panel Assembly over a modem, use the NT7R66BA MMI Cable and a nullmodem to connect the modem to the MMI D-9 male connector on the NT7R61AA Remote Maintenance Panel Assembly.

4 For multiple Carrier Remote IPE modules at a single site, use an A/B/C switch box to connect each MMI DB-9 male connector on the Maintenance Panel assembly to a single MMI terminal. To do this, use the NT7R66BA MMI Cable between the A/B switch box connector C and the MMI connector on each IPE module. Use a DB-25M/ DB-25M straight through cable to connect the A/B switch box connector A to the MMI terminal.

Note: Appendix C provides the external connectors pin assignment for the SDI port, the MMI terminal, the carrier links, and the external alarms.

Connecting the carrier link to the Remote IPE module

The T1 or E1 carrier links are connected to the I/O panel assembly at the rear of the IPE module housing the Remote Carrier Interface card. Carrier links are routed from the telco demarcation point to the Carrier Remote IPE column for connection to the NT7R59AA Carrier Panel and the NT7R60AA Carrier/Alarm Panel assembly. The NT7R59AA Carrier Panel assembly contains two 8-pin modular jacks and the NT7R60AA Carrier/Alarm Panel assembly contains one 8-pin modular jack, which are used to connect carrier links. Figure 16 shows the carrier connectors and the carrier link cable routing.

Note 1: Before connecting the carrier link to the system, the connection between the telco demarcation point such as CSU, should have been completed using the NT7R87AA T1 CSU Cable Kit.

Note 2: To connect an E1 carrier terminated with BNC connectors, use the NT7R67EA Coaxial Interface Adapter Cable to connect the 8-pin modular jacks at the I/O panel to the BNC connector on each E1 carrier link coming from the telco demarcation point. Also refer to Figure 9 and Figure 15 to set SW1, SW2, SW5, and SW8 for E1 operation and carrier impedance of 75 Ohm.

To connect carrier links to the IPE module's NT7R59AA Carrier Panel and NT7R60AA Carrier/Alarm Panel assemblies at the remote site:

1 Route all three carrier links to the rear of the Carrier Remote IPE column housing the Remote Carrier Interface card.

2 Identify carrier 0 (primary), carrier 1 (primary), and carrier 2 (primary or spare) and the corresponding connectors on the NT7R59AA Carrier Panel and the NT7R60AA Carrier/Alarm Panel assemblies.

Note: Compare carrier circuit ID numbers of carrier links at the local site (that you recorded during the installation of the carrier links at the local site) with the carrier circuit ID numbers of the carrier links at the remote site. Make sure they match so that the circuit ID of carrier 0 at the local site matches with circuit ID of carrier 0 at the remote site. Repeat this matching for carrier 1 and carrier 2. This will eliminate cross-connection of carrier links, which causes transmission problems. Refer to "Verifying carrier link connections at the remote site" on page 159.

3 Plug each carrier cable 8-pin modular plug into the corresponding 8-pin modular jack on the NT7R59AA Carrier Panel and the NT7R60AA Carrier/Alarm Panel assemblies for each T1 carrier.

4 If an E1 coaxial carrier link is terminated with BNC connectors, use one NT7R67EA Coaxial Interface Adapter cable to connect each 8-pin modular jack on the NT7R59AA Carrier Panel and NT7R60AA Carrier/Alarm Panel assemblies to BNC carrier link connectors.

5 Identify BNC connectors on each NT7R67EA Coaxial Interface Adapter cable that corresponds to the appropriate carrier (carrier 0, carrier 1, and carrier 2) at the NT7R57AA Carrier Panel Assembly 8-pin jack.

6 Connect each NT7R67EA Coaxial Interface Adapter BNC connector to the appropriate BNC connector on the carrier link.

Note: These carrier link connections will be verified at the end of hardware installation by executing appropriate MMI commands on the MMI terminal. Refer to "Verifying carrier link connections at the remote site" on page 159.

7 Secure the carrier link cables with tie-wraps as appropriate.

The NT7R60AA Maintenance Panel assembly that contains one 8-pin modular jack for carrier 2, also contains the DB-15HD female external alarm input connector. This DB-15HD connector connects the NT7R86AA Auxiliary Alarm Cable assembly to auxiliary alarm (external alarm) indicators at the MDF or directly to the auxiliary alarm devices. These alarm devices report alarm conditions through relay contact closures.

Carrier Remote IPE cabinet installation

To complete the installation of Carrier Remote IPE cabinet equipment, you must:

— install the Carrier Remote IPE cabinet(s)

— install cards into the cabinet(s)

— install the Remote Cabinet Cable assembly and connect to the backplane

— connect the carrier links

Installing the Carrier Remote IPE cabinet

To install NT1P70/NT1P60 main and NTBK70 expansion Carrier Remote IPE cabinets that house the Carrier Remote IPE, follow the instructions in this section.

> ***Note:*** The NT1P70 is the Main Cabinet Assembly consisting of the NT1P60 Main Cabinet and cabinet mounting hardware.

The NT1P70/NT1P60 Remote Carrier IPE main cabinet is shipped from the factory installed, that is, all IPE cards and the Remote Carrier Interface card are already installed. The exceptions are the NT7R94AA Remote Cabinet Cable Assembly and the power supply, which are shipped separately. The NTBK70 Carrier Remote IPE expansion cabinet (also used in Option 11) is optional and is ordered only if you require more than 10 IPE cards at the remote site.

The Carrier Remote IPE cabinet can be powered with an AC power system using the NTAK04 AC/DC power supply. It can also be powered with a DC power system using the NTAK05 DC power supply from a –52 V battery source through the NTAK28AA Junction box and the NTAK410 power cable. Before you install the power supply into the cabinet set switches SW1 through SW 4 as shown in Table 14:

Table 14
NTAK04 AC/DC and NTAK05 DC power supply switch settings

Voltage	SW1	SW2	SW3	SW4
Message Waiting; -150 V	ON			
Message Waiting; -120 V	OFF			
Ringing; 86 Vrms		OFF	OFF	OFF
Ringing; 80 Vrms		ON	OFF	OFF
Ringing; 75 Vrms		OFF	ON	OFF
Ringing; 70 Vrms		OFF	OFF	ON

Note: Ringing frequency selection is made with a three-way switch located to the left of the 4-position DIP switch at the top of the power supply. Typical North American setting is -150 V, 86 Vrms, and 20 Hz.

To install Carrier Remote IPE Cabinets, locate and prepare the wall area for the wall-mounted installation or use the pedestal for the floor installation, install cabinets, connect the ground wires, and connect the power. When selecting the wall area for the cabinet installation, make sure you provide for convenient carrier and subscriber loop cable routing.

To complete these tasks, follow the steps below:

1 Unpack and inspect the cabinet.

2 Level and install the mounting bracket on the wall as shown in Figure 17. If you are installing the expansion cabinet next to the main, line up the two brackets and use the provided spacer between brackets.

3 Remove the front cover and all cards from the cabinet to make the cabinet lighter and to prevent card damage in case the cabinet drops when being installed onto the wall.

4 Position the cabinet over the mounting bracket so that the bracket hook engages the slot at the rear of the cabinet. The slot is located at the top center of the cabinet as shown in Figure 17.

5 Bolt the cabinet to the wall by using two wood screws at the lower front of the cabinet. See Figure 17 for screw hole locations.

6 Install the 6 AWG copper ground wire between the approved building ground and the ground lug at the bottom of the cabinet.

7 Repeat steps 3 through 6 for the expansion cabinet, if required.

8 Install the power supply in the *Pwr Sup* slot in the NT1P70/NT1P60 main cabinet shelf and turn the power switch to OFF.

9 At the building ground end of the wire, use two fastening clamps to connect the wire to the building ground, insulate the connection with electric tape, and post a DO NOT DISCONNECT tag.

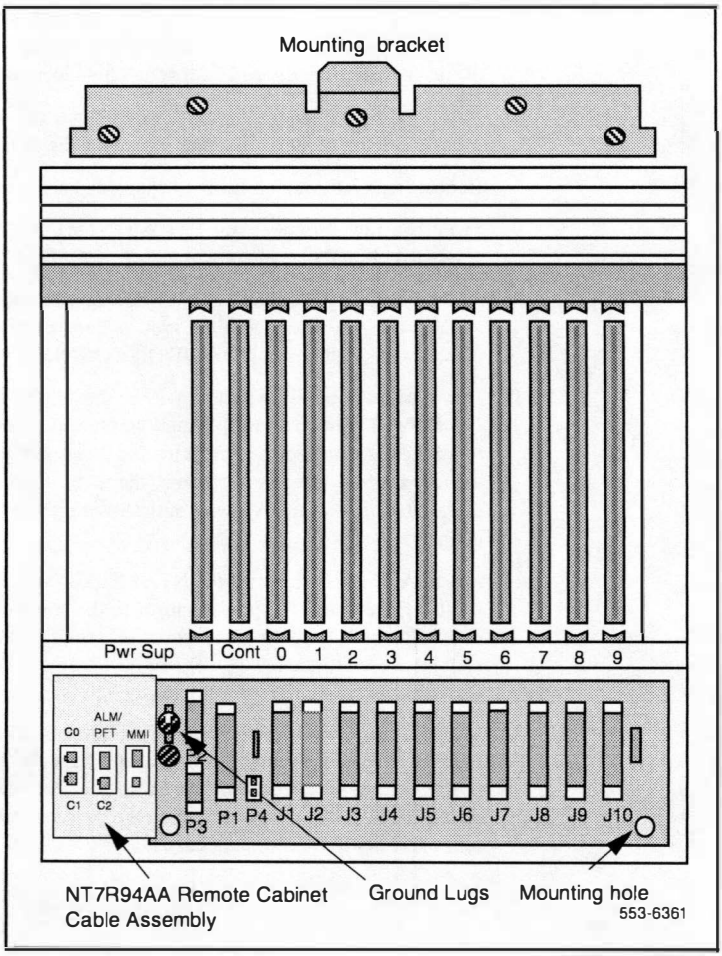
10 Disconnect the building ground wire at the ground lug on the NT1P70/NT1P60 main cabinet and measure the resistance between the tip of the disconnected ground wire and the ground lug on the cabinet. If the resistance is more than 5 ohms, check the building ground and the ground terminal at the AC wall outlet where the cabinet power cord is connected.

11 For an AC system, connect the NTAK98AA Power Cord from the IPE shelf NTAK04 AC/DC power supply to the commercial AC power outlet. For a DC system, connect the IPE shelf NTAK05 DC power converter cord to the DC power source over the NTAK28AA Junction Box and the NTAK410 power cable.

12 Measure the ground resistance between the ground lug at the bottom of the NT1P70/NT1P60 main cabinet and the ground prong on the cabinet power cord. It should measure 0 ohms. If the resistance is greater than 0 ohms, check the ground terminal on the power supply power connector for continuity to the cabinet chassis.

Figure 17 shows the Carrier Remote IPE cabinet with the mounting bracket and the mounting holes. It also shows the ground lugs for ground connections.

Figure 17
Carrier Remote IPE cabinet



13 Disconnect the power cord from the wall outlet for the AC system or the DC power source for the DC system and reconnect the 6 AWG ground wire to the cabinet ground lug.

14 Reconnect the NTAK98AA supply power cord to the AC power outlet for an AC system or to the DC source for a DC system.

15 If the Carrier Remote IPE requires an expansion cabinet to accommodate up to 16 IPE cards, repeat steps 1 through 14 for the NTBK70 expansion cabinet.

16 Connect the NT1P70/NT1P60 main cabinet to the NTBK70 expansion cabinet by installing the cable between connector P1 of the main cabinet and P1 of the expansion cabinet. Install the cabinets side-by-side or above each other keeping in mind that the inter-cabinet cable is 7 feet (21 m) long.

17 Install the adhesive label strip to the expansion cabinet designating the card slots from 10 to 15.

This completes the cabinet installation and system ground test. You can now install the plug-in cards.

Removing the fiber I/O bracket assembly

The NT1P70/NT1P60 main Carrier Remote IPE cabinet is equipped with a I/O bracket assembly used in Fiber Remote IPE. This bracket must be removed and the NT7R94AA Remote Cabinet Cable Assembly must be installed in its place. Refer to Figure 18.

To remove this bracket:

1 Unscrew the retaining screw holding the bracket in place. The screw is located at the upper front of the bracket.

2 Remove the retaining screw and swing the front of the bracket to the left by 45 degrees.

3 Slide the entire bracket forward to clear the hinge tabs at the rear of the bracket. Remove the bracket.

Installing the NT7R94AA Remote Cabinet Cable Assembly

The NT7R94AA consists of the NT7R62AA Bracket, the NT7R68CA Remote Carrier/Alarm Cable Assembly, and the NT7R68DA Remote Maintenance Cable Assembly. These components are pre-assembled in the factory to become the NT7R94AA Remote Cabinet Cable Assembly.

To install the NT7R94AA Remote Cabinet Cable Assembly into the cabinet:

1 Align the two bracket holes with the two hinge tabs as shown in Figure 18.

2 Swing the front of the assembly by 45 degrees to the left with respect to the hinge tabs.

3 Slide the entire assembly backwards and insert the hinge tabs into the two holes on the bracket.

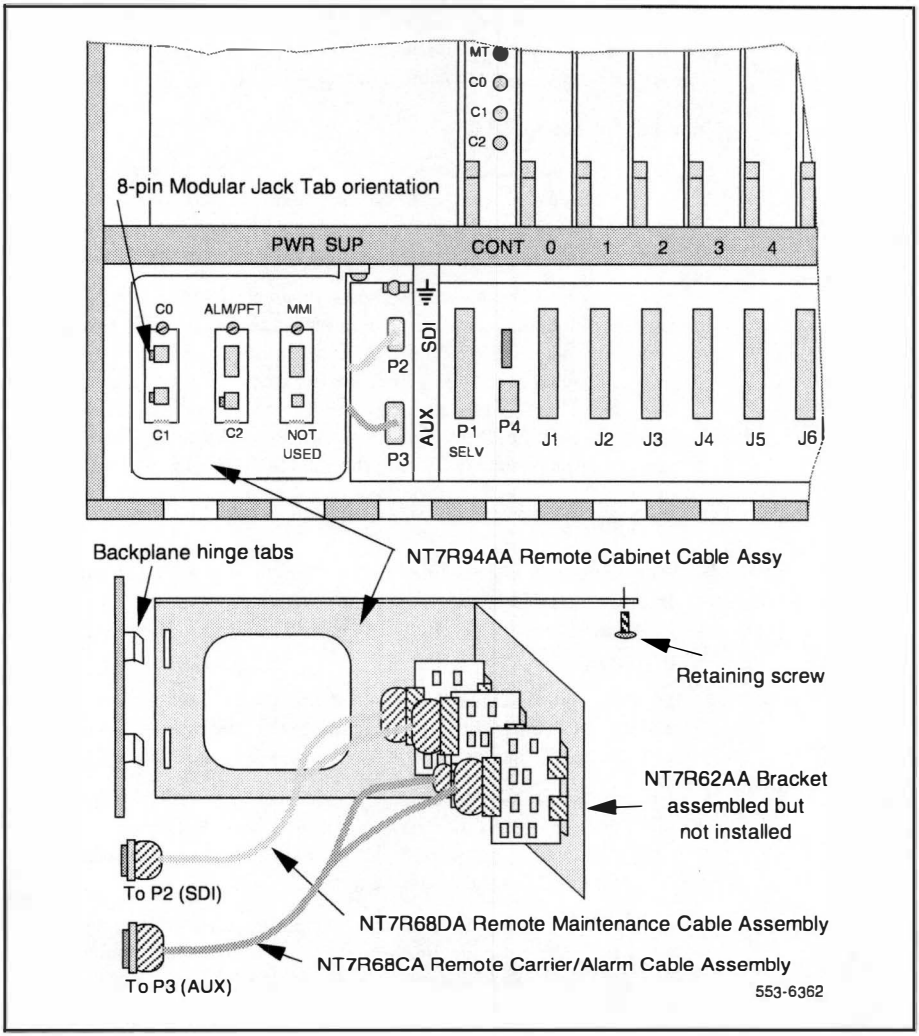
4 Move the front of the assembly by 45 degrees to the right to be at the right angle to the backplane and install the retaining screw.

5 Plug the DB-15 male P1 connector at the common end of the NT7R68CA cable assembly into the P3 (auxiliary) DB-15 female connector located on the backplane.

6 Plug the DB-9 male P1connector at the common end of the NT7R68DA cable assembly into the P2 (TTY) DB-9 female connector located on the backplane.

Figure 18 shows an installed and connected Remote Cabinet Cable Assembly. The cables are connected to P2 and P3 located on the cabinet backplane to provide connections to carrier links, the SDI/MMI terminal or TTY, the PFTU, and the customer external alarms (alarms 1 and alarm 2 only).

Figure 18
Carrier cable routing for the Carrier Remote IPE cabinet



Installing cards into the Carrier Remote IPE cabinet

The following steps show you how and where to install the cards in the Carrier Remote IPE cabinet. Even though the cards are shipped in the cabinet from the factory, for safety and ease of installation, you were instructed to remove these cards from the cabinet before you installed it onto the wall.

To install these cards:

1 Set the DIP switches on the NT7R52 Remote Carrier Interface card to specify the carrier type (T1 or E1), the distance to the first repeater, the terminal characteristics, and the system monitor address emulation. The DIP switch setting will depend on the physical system configuration.

Note: Figure 15 on page 119, shows the location of the DIP switches and their functions. Switches 2, 3, and 4 determine if carrier 0 is a T1 or an E1 link, switches 4, 6, and 7 determine if carrier 1 is a T1 or an E1 link, and switches 8, 9, and 10 determine if carrier 2 (spare carrier) is a T1 of an E1 link. All three carrier links must be of the same type, that is, T1 or E1. Switches 2 through 10 are not read by firmware. Switches 1 and 11 define parameter listed in the table of Figure 15. Verify that SW1 position 2 is set to **ON** to indicate remote site. Switches 1 and 11 are read by firmware.

2 Pull the Remote Carrier Interface card locking devices away from the faceplate and, holding the card by these devices, insert the card into the card guides in slot *Cont*. Refer to Figure 17 on page 132 for card slot positions in the shelf.

3 Slide the card into the cabinet until it engages the backplane connector and then push the locking device levers toward the faceplate to insert the card connector into the backplane connector and lock the card in place.

4 Observe the LED on the card as it performs self-tests. The LED should blink three times and then stay on until The Remote Carrier Interface card is enabled by software. When enabled by software, the LED turns off permanently, if the card is operational.

5 Install IPE cards in slots 0 through 9 by pulling the card locking devices away from the faceplate, inserting the cards into the card guides, engaging the backplane connector, and locking the card in place by pressing the locking devices against the card faceplate.

6 Repeat step 5 for card slots 10 through 15 in the expansion cabinet.

Connecting carrier links to the Carrier Remote IPE cabinet

In the Carrier Remote IPE cabinet configuration, the carrier link connects to the telco demarcation point and, from the telco demarcation point, the carrier link cables are routed to the cabinet and connected to the Remote Carrier Interface card through the NT7R59AA Carrier Panel and the NT7R60AA Carrier/Alarm Panel assemblies, as shown in Figures 18 and 19.

Note 1: Before connecting the carrier link to the system, the connection between the telco demarcation point such as CSU, should have been completed using the NT7R87AA T1 CSU Cable Kit.

Note 2: To connect an E1 carrier terminated with BNC connectors, use the NT7R67EA Coaxial Interface Adapter Cable to connect the 8-pin modular jacks at the I/O panel to the BNC connector on each E1 carrier link coming from the telco demarcation point. Also refer to Figure 9 and Figure 15 to set SW1, SW2, SW5, and SW8 for E1 operation and carrier impedance of 75 Ohm.

To connect the carrier link to the carrier panel assemblies:

1 Route the T1 or E1 carrier 0, carrier 1, and carrier 2 (spare carrier) pair wires from the telco demarcation point to the Carrier Remote IPE cabinet I/O bracket.

2 Identify carrier 0, 1, and 2 connectors and the corresponding NT7R59AA Carrier Panel and the NT7R60AA Carrier/Alarm Panel assemblies connectors. Refer to "Verifying carrier link connections at the remote site" on page 159.

Note: Compare carrier circuit ID numbers of carrier links at the local site (that you recorded during the installation of the carrier links at the local site) with the carrier circuit ID numbers of the carrier links at the remote site. Make sure they match so that the circuit ID of carrier 0 at the local site matches with circuit ID of carrier 0 at the remote site. Repeat this matching for carrier 1 and carrier 2. This will eliminate the mismatched connection of carrier links, which causes time slot connection problems indicated by no talk-path or cross-talk. To avoid this problem, refer to "Verifying carrier link connections at the remote site" on page 159.

3 Plug the carrier link 8-pin modular plug into the corresponding NT7R59AA Carrier Panel and the NT7R60AA Carrier/Alarm Panel assemblies 8-pin modular jack for each carrier.

4 If an E1 coaxial carrier link is terminated with BNC connectors, use one NT7R67EA Coaxial Interface Adapter cable to connect each 8-pin modular jack on the NT7R59AA Carrier Panel and NT7R60AA Carrier/Alarm Panel assemblies to BNC carrier link connectors.

5 Identify BNC connectors on each NT7R67EA Coaxial Interface Adapter cable that corresponds to the appropriate carrier (carrier 0, carrier 1, and carrier 2) at the NT7R57AA Carrier Panel Assembly 8-pin jack.

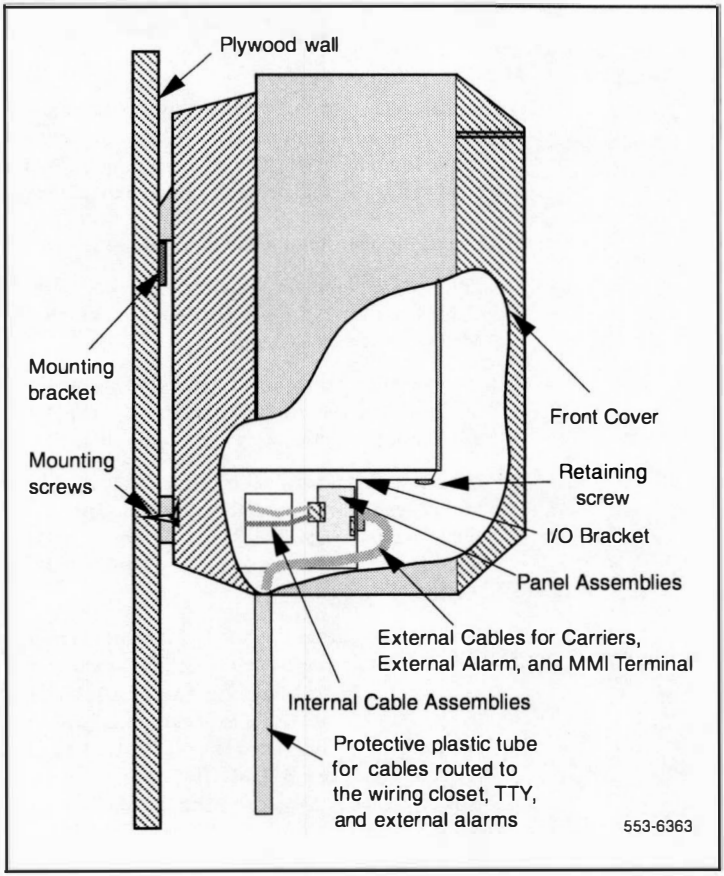
6 Connect each NT7R67EA Coaxial Interface Adapter BNC connector to the appropriate BNC connector on the carrier link.

Note: These carrier link connections will be verified at the end of hardware installation by executing appropriate MMI commands on the MMI terminal. Refer to "Verifying carrier link connections at the remote site" on page 159.

7 Secure the carrier link cables with tie-wraps at the exit from the cabinet as appropriate.

Figure 19 shows the Carrier Remote IPE cabinet and the carrier cable connecting carrier links to the cabinet.

Figure 19
Carrier cable routing for the Carrier Remote IPE cabinet



Connecting remote MMI terminal and subscriber loop cables

In the Carrier Remote IPE cabinet option, the alarm monitoring is performed by the Remote Carrier Interface card, which receives power fail signals from the power supply through the backplane and sends the information over carrier links to the Local Carrier Interface card for processing by the Meridian 1 CPU. Refer to Appendix C, Figure 30 for the connection diagram.

MMI terminal connection

A terminal connection to the MMI port should be made as shown in Figure 20. The MMI terminal is used for configuration and maintenance of the remote site. The MMI terminal transmission characteristics are 2400 bps, 8 bits, no parity (or emulate the VT100 dumb terminal).

To connect the MMI terminal to the MMI port:

1 Plug the DB-9 female connector at one end of the NT7R66BA MMI Cable into the MMI DB-9 male connector on the NT7R61AA Maintenance Panel assembly.

2 Plug the DB-25 male connector end of the NT7R66BA MMI Cable into the MMI terminal RS-232 connector. If the MMI terminal requires a different gender connector use a compact gender changer.

3 If a distant MMI terminal is connected to the MMI connector on the Maintenance Panel Assembly over a modem, use the NT7R66BA MMI Cable and a DB-25F/DB-25M nullmodem to connect the modem to the MMI D-9 male connector on the NT7R61AA Maintenance Panel Assembly.

4 For multiple Carrier Remote IPE modules at a single site, use an A/B/C switch box to connect each MMI DB-9 male connector on the Maintenance Panel assembly to a single MMI terminal. To do this, use the NT7R66BA MMI Cable between the A/B switch box connector C and the MMI connector on the NT7R61AA Maintenance Panel Assembly and use DB-25M/ DB-25M straight through cable between the A/B switch box connector A and the MMI terminal.

Main Distribution Frame connections

To connect subscriber loop (tip and ring) cables to the cabinet 50-pin connectors J1 through J10, refer to Figure 20. If an expansion cabinet is also used, connect subscriber loop (tip and ring) cables to the cabinet 50-pin connectors J11 through J16. These cables have already been connected to the MDF in the preinstallation preparation phase according to the instructions in "Cabling lines and trunks" in *System Installation Procedures* (553-3001-210):

1 Remove the locking bar from connectors designated J1 through J10.

2 Install the 50-pin connector terminating the MDF cable marked J1 and plug it into the connector at the bottom of the cabinet also designated J1.

3 Repeat step 2 for the remaining MDF cables from J2 through J10 for card slot 1 through 9.

4 If the expansion cabinet is also installed, identify the 50-pin connectors terminating the MDF cable designated J11 through J16 and plug them into their respective connectors at the bottom of the cabinet also designated J11 through J16 for card slots 10 through 15.

5 Replace the locking bar(s) in the cabinet(s) over the cable connectors.

Auxiliary alarm connections

To connect the auxiliary or external alarm indicators to the NT7R60AA Carrier/Alarm Panel assembly connector, use the NT7R86AA Auxiliary Alarm Cable assembly:

1 Plug the NT7R86AA Auxiliary Alarm Cable assembly DB-15HD male cable connector into the DB-15HD female connector on the NT7R60AA Carrier/Alarm Panel assembly. The DB-15HD connector pin assignment is shown in Appendix C, Table 29.

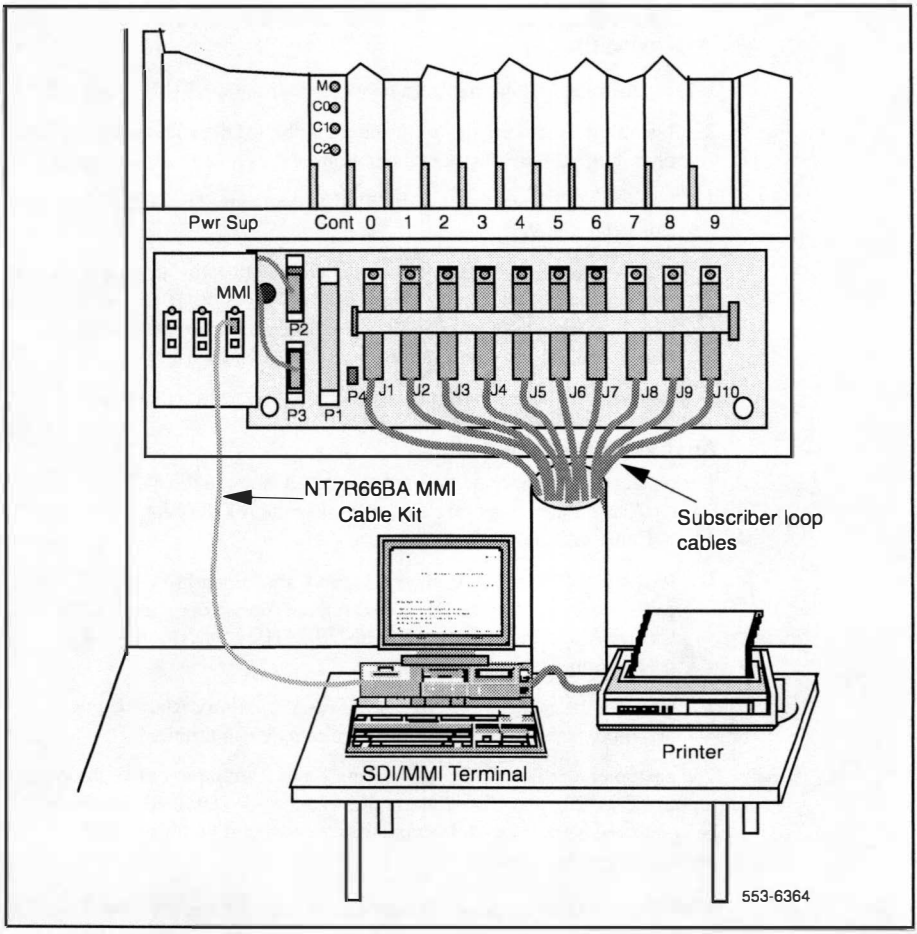
2 Connect the other end of the NT7R86AA Auxiliary Alarm Cable assembly bare wires to the external alarm device terminals.

The customer auxiliary (external) alarms 1 and 2 are input only alarms that produce CRI33n1 and CRIn2 alarm messages when activated. These should be connected across open relay contacts. No external voltage should be present across the contacts.

The customer auxiliary alarm feature can be used for any premise alarm application where an alarm condition activates a relay contact closure.

Figure 20 shows the subscriber loop (tip and ring) connectors that link line cards to the MDF and the terminal connection. It also shows the MMI terminal connection to the NT7R61AA Maintenance Panel DB-9 connector.

Figure 20
TTY and subscriber loop cable connections



Connecting the attendant to the Carrier Remote IPE cabinet

The Carrier Remote IPE cabinet backplane contains P4, a 2-pin power connector which provides a +15 V and –15 V power source for the attendant console.

To make this connection:

1 Connect the attendant console power cord to P4 connector (±15 V power pins) on the Carrier Remote IPE cabinet backplane.

2 Install and configure the attendant console. Refer to *Telephone and Attendant Console: Installation* (553-3001-215) and *M1250 and M2250 Attendant Consoles: Description* (553-2201-117).

Connecting the PFTU to the Carrier Remote IPE cabinet

In the Carrier Remote IPE cabinet option, the Power Fail Transfer Unit (PFTU) is connected as shown in Figure 21.

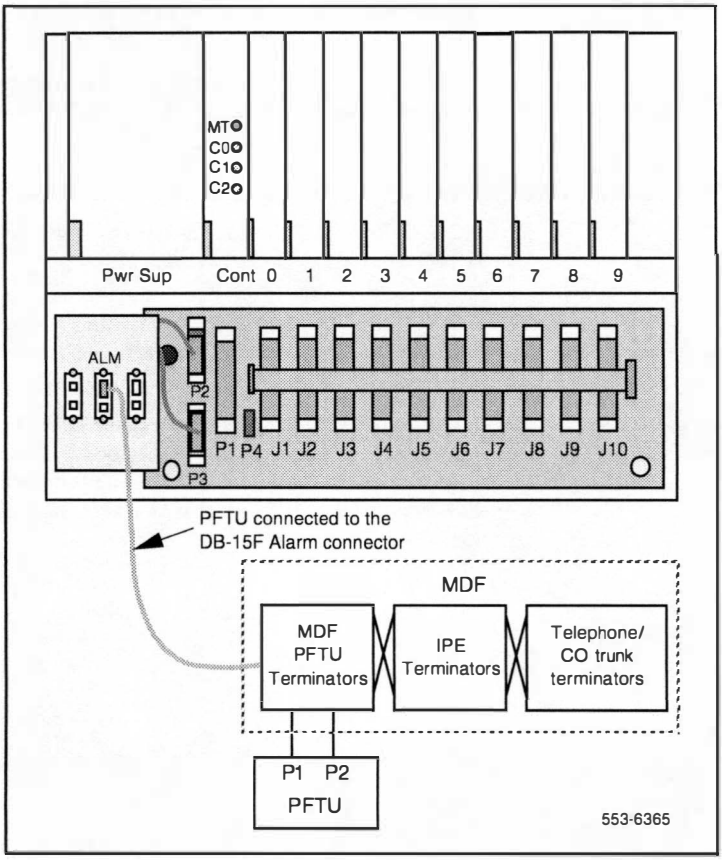
To make this connection:

1 Install the PFTU near the MDF and connect it to the MDF according to the instructions in the PFTU user manual.

2 Install the NT7R86AA cable between the PFTU and the NT7R60AA Carrier/Alarm Panel assembly connector DB-15 female (Alarm) connector on the Carrier Remote IPE cabinet. For more information on how to install the PFTU, refer to *System Installation Procedures* (553-3001-210).

Figure 21 illustrates the front view of the Carrier Remote IPE cabinet. It shows the connection of the NT7R60AA Carrier/Alarm Panel assembly DB-15 female (Alarm) connector on the Carrier Remote IPE cabinet linking the cabinet to the PFTU and the MDF.

Figure 21
Connecting the PFTU to the Carrier Remote IPE cabinet



Configuring the Carrier Remote IPE

The configuration and administration of the Carrier Remote IPE and the corresponding carrier equipment at the Meridian 1 local site are identical to the standard Meridian 1 configuration and administration and do not require special considerations.

However, there are some initial setup functions that must be considered at the local and the remote sites. These functions are administered over a man machine interface (MMI) port connected to a terminal or a TTY at the local and the remote site.

When configuring Carrier Remote IPE functions at the local and the remote sites you can configure:

— Local and Remote Carrier Interface cards using Configuration Record programs LD 17 and LD 97

— Carrier parameters using the MMI commands

Configuring the carrier interface cards

When the Carrier Remote IPE equipment is first installed, you must define the Local Carrier Interface and Remote Carrier Interface cards as standard NT8D04 Superloop Network and NT8D01 Peripheral Controller cards.

To do this you must:

— print the current system configuration record to identify possible available superloops

— remove an existing superloop data block if it already exists for a non-carrier superloop

Note: To remove superloop data blocks, remove all terminal numbers (TNs) associated with the peripheral controller, disable the superloop, and remove the data block associated with the peripheral controller. You can also move data blocks of one superloop to a different superloop number using Move Data Blocks Program LD 25.

— configure a superloop data block to correspond to the Local Carrier Interface card

— configure a peripheral controller data block to correspond to the Remote Carrier Interface card

Before you can define a carrier superloop, you must find available superloops in the system. To do this, logon and print system configuration data using Print Program LD 22. If you don't know how to logon refer to "Logging in on the maintenance terminal" on page 191.

Request CFN printout

Prompt	Response	Comment
REQ	PRT	Print request
TYPE	CEQU PKG, PSWV	Configuration data

CFN configuration data print format- find unused superloop

CEQU		
MPED	SD/DD/4D/8D	Prints maximum peripheral density for the system (use 8D for systems with IPE)
TERM	xxx xxx xxx...	Prints all terminal loops
REMO	xxx xxx xxx...	Prints remote EPE loop numbers configured in LD 17
SUPL	xxx xxx xxx...	Lists all local Superloop Network card superloop numbers
SUPC	xxx xxx xxx	Lists all carrier remote superloops when REM_IPE 286 software package is installed
PKG		
REM_IPE	286	Software package for Carrier Remote IPE
PSWV		
XPEC:	XX	Software version number
LCRI:	XX	Software version number downloaded to Local Carrier Interface cards. A forced PSDL is initiated upon execution of the ENLL and ENXP commands (Note).

Note: Parameter Software Download (PSDL) ensures that the latest loadware is downloaded into the Local and Remote Carrier Interface cards. PSDL is initiated upon:

Initialization (INIT).

ENXP after power reset or the Local or Remote Interface card.

ENXP of the Remote Carrier Interface card by adding peripheral software version parameter after the Peripheral Controller ID.

ENLL of the Local Carrier Interface card by adding the PSW version parameter after the SUPC number.

To change the system configuration record and to configure the Remote Carrier Interface at the Carrier Remote IPE column or cabinet site, load Configuration Record Program LD 17 and Configuration Record Program LD 97.

To change the system configuration record (LD 17)

Prompt	Response	Comment
REQ	CHG	Change the configuration record
TYPE	CFN	Configuration record
CEQU	YES	Change equipment
MPED	8D	Peripheral density

To configure the Remote Carrier IPE site (LD 97)

REQ	CHG	Remote Carrier Interface definition
TYPE	XPE	Remote Peripheral Controller (RCI) ID
SUPL	0-156	Prints superloop type and number
XPEC	2	Controller ID number.
LOC	SCLARA	remote site location example. Use any six alphanumeric characters to identify the remote site.
RGTP	(8)/16	Number of concurrent ringers. Change to 16 unless ringing generator is an older type.

After you have you have defined the new Peripheral Controller (RCI) define the superloop for the Local Carrier Interface card.

To define a carrier superloop

Prompt	Response	Comment
REQ	CHG	Adding a new Local Carrier Interface card
TYPE	SUPL	Adding a superloop for the Local Carrier Interface card.
SUPL	0–156	Superloop number
SLOT	(L)/R	Superloop card side for the Local Carrier Interface card, where L (left) is default position.
SUPT	CARR	Carrier superloop type. Prompted when REM_IPE 286 software package is installed.
XPEC	1–95	Remote Carrier Interface card (Controller ID number) previously equipped. Defaults to shelf 0 segment 0-3 for SUPT = CARR

To configure the Carrier Remote IPE superloop and the Carrier Remote IPE column or cabinet site, load Configuration Record Program LD 17 and Configuration Record Program LD 97.

Configuring the SDI port for the Local Carrier Interface card connection (LD 17)

REQ	CHG	Change the SDI record
TYPE	CFN	Configuration record
IOTB	YES	
HIST		I/O terminal history file buffer length
ADAN	NEW/TTY 0–15	Add, change, or remove an I/O device, type aaa, or port x
USER	BUG, MTC, SCH	Enter one of the output message types that will be the message of this port
XSM	(NO)	SDI port for the system monitor

To enable the superloop for the Local Carrier Interface card and the Remote Carrier Interface card, load Maintenance and Diagnostic Program LD 32 and execute the **ENLL x** command.

To enable the carrier superloop x

Command	Response	Comment
ENLL x	ok & prompt	Enables specified superloop **x**

To remove the configuration of the Remote IPE superloop, load Maintenance and Diagnostic Program LD 32 and execute the **DISL x** command to disable the superloop, and then load Configuration Record Program LD 97 to delete the configuration records of the superloop for the Local Carrier Interface card and the Remote Carrier Interface card.

To delete the configuration record for the carrier superloop

Prompt	Response	Comment
REQ	CHG	Deleting the Local Carrier Interface card configuration record
TYPE	SUPL	Carrier superloop
SUPL	X8	Remove record for superloop number 8

To delete the configuration record for the Carrier Remote IPE module (shelf)

REQ	CHG	Change configuration record
TYPE	XPE	Remote Carrier IPE
XPEC	X2	Delete configuration record for peripheral controller 2, i.e., the Remote Carrier Interface card

To check the carrier status, loading the LD 32 and executing the **STAT** <SUPC>, where <SUPC> is the Local Carrier Interface superloop number. For additional examples of carrier status, refer to the Maintenance section, Procedure 7 "Checking the carrier performance status" on page 212.

LD 32
NPR000
STAT sl

CARR	CALS	TTSA	NND	SPARED
0	0	21/21	NO	NOT SPARED
1	0	21/21	NO	NOT SPARED
2	0	N/A	N/A	AVAIL

Parameter description:
CARR—Carriers 0, 1, and 2 (carrier 0 has priority over carrier 1 when sparing carrier links)
CALS—Carrier Alarm Status (0 indicates Alarm Level 0 indicates no alarm)
TTSA—Timeslots currently available for voice and data (n/21 for T1 and n/27 for E1)
NND—Indicates if No New Data is disallowed (NO = not disallowed)
SPARED Indicates if a carrier is spared (in the example none are spared) and N/A indicates that carrier 2 is primary not spare

Configuring the remote MMI terminal port

The MMI port can be configured in the SDI or the MMI mode. When the MMI terminal is in the SDI mode, you can perform system administration tasks from the local or the remote site. When the MMI terminal is in the MMI mode you can:

- perform carrier functions such as display status, logs, performance information, history, and messages
- enable or disable alarms
- clear errors and logs
- set performance parameters
- specify tests

MMI mode

In the MMI mode, a terminal or TTY is connected to the local MMI port at the Local Carrier Interface card and another terminal or TTY is connected to the MMI port at the Carrier Remote IPE as described in *Installing SDI and TTY cables* in this chapter. Each terminal controls the local MMI functions of the card it is connected to and some display functions at the distant site.

The default MMI interface characteristics are set in the Local and Remote Carrier Interface card EEPROM as follows:

— Speed: 2400 bps (speed is an exception, it is selected using DIP SW1 position 1 where OFF = 2400 bps and ON = 1200 bps)

— Character width: 7

— Parity bit: mark

— Stop bit: 1

The MMI mode is accessed from the initial (INIT) mode by entering **L** on the MMI terminal or TTY to log in. For multiple Local Carrier Interface cards connected in a daisy-chain, to log in to the specified Local Carrier Interface card, enter **L <sl>**, where **sl** is the address and the superloop number of the specified superloop, as shown in Figure 22 and Table 11, "NT7R51 Local Carrier Interface card maintenance daisy-chain address," on page 81.

Password is **M1LINK**

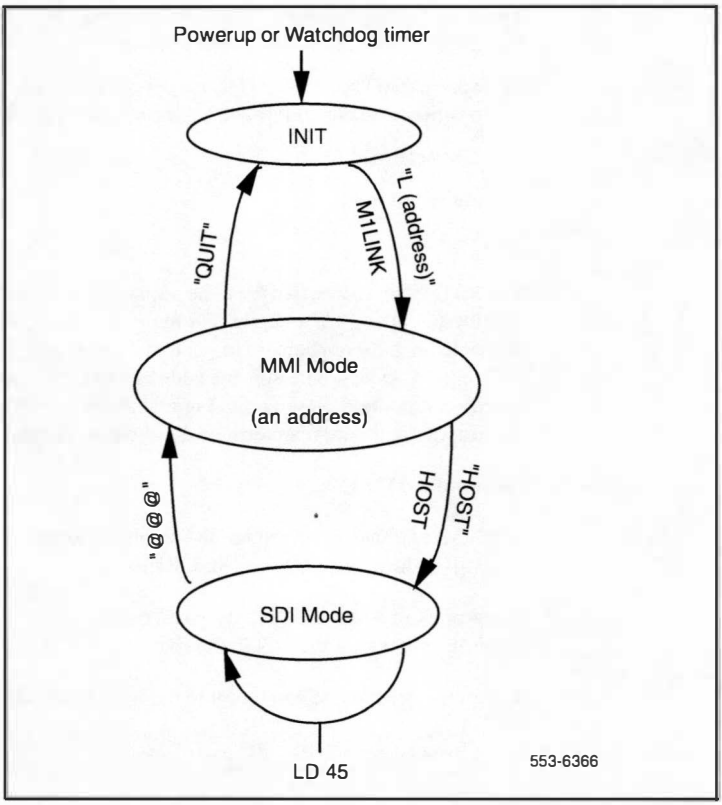
The MMI command line prompt in the initial mode is: **CRI>**, but after logging in, the prompt changes to: **CRI::>**

The prompt in a Maint/SDI daisy-chain configuration is **CRI: nnn>**, where nnn is the address of the LCI in the chain.

To exit the MMI mode and return to the INIT mode, enter **Q** at the terminal or TTY.

Figure 22 shows modes that a terminal or a TTY can be in and paths taken to transition from one mode to the next. The three modes are Initial, MMI, and SDI. The words in quotation marks shown along the paths must be entered on the terminal to go from one mode to the next.

Figure 22
TTY or terminal modes at the local and the remote sites



Host SDI mode

In the Host SDI mode, a terminal is connected to the MMI port at the Carrier Remote IPE. This terminal becomes the Meridian 1 maintenance and service change TTY. At the Meridian 1 site the Local Carrier Interface card connects to the MMI port and to an SDI port of an SDI card.

For the MMI port at the Remote Carrier Interface card to be able to communicate over the SDI port connected to the Local Carrier Interface card, the interface characteristics must be the same:

— Speed: 2400 bps or 1200 bps (Set by SW1 position 1)

— Character width: 7 bits

— Parity bit: mark

— Stop bit: 1

In this mode, the remote TTY or terminal becomes a Meridian 1 system TTY that can access overlays and perform system configuration, maintenance, and diagnostics, which are the same functions performed by the local Meridian 1 system TTY.

To log into the host for SDI operation, you should first log in using the MMI terminal in the MMI mode, then you should log into the terminal as host:

CRI>L	Login command
CRI::>	Prompt after logging in
Enter Password > **M1LINK**	Type in the password.
CRI::> **HO**	To access the Host SDI mode
Enter Password > **HOST**	Enter the password **HOST**

The Host SDI mode is accessed from the MMI mode by entering **HOST** at the terminal or TTY. In this mode you can configure and maintain the entire Meridian 1 system. Figure 22 shows that, for example, LD 45 can be activated to perform loopback testing.

To exit this mode, enter **@@@**.

Configuring the carriers

To configure the Carrier Remote IPE using the MMI terminal, you must logon, enter the password, and use appropriate MMI commands.

Note: The commands are not case sensitive (you can use upper or lower case letters). The exception is the password, which must always be entered in upper case.

Default factory carrier configuration

Carrier 0 equipped
Carrier 1 equipped
Carrier 2 equipped (not a spare)
Alarms enabled (automatic clearing of Carrier Alarm Indication)

Before you start configuring the Carrier Remote IPE, you should check the current (default) configuration and determine whether the communication is established with the distant end. The S A and the S C commands affect the distant end automatically only when the distant end is communicating.

To display the configuration parameters, execute the **D C** command on the MMI terminal. This is an example of what the MMI terminal may display:

CRI::> D C
CRI Remote IPE S/N L1105-A4 Software Version 1.00 8/17/95 10:48
Local Site
Alarm Enabled: YES Self Clearing Enabled: YES
Sparing Enabled/Disabled: Enabled
All Link Maps Normal
Alarm Level 1 Threshold Value E-6 Threshold Duration (in seconds) 1
Alarm Level 2 Threshold Value E-5 Threshold Duration (in seconds) 1
Alarm Level 3 Threshold Value E-4 Threshold Duration (in seconds) 1
Frame Slip Alarm Level Threshold 100 Threshold Duration (in hours) 2
Current DIP Switch S1 Settings (s1-s8) OFF OFF ON ON OFF ON ON OFF
Current DIP Switch S11 Settings (s1-s8) OFF OFF OFF ON ON OFF OFF OFF

Unless you have a particular reason to change the default parameters, you should leave then unchanged.

Execute the **D C D** command for the distant site and compare the configuration settings at the local and the remote sites. If you are able to obtain the distant configuration report and they are both configured correctly, the MicroLink is up and the communication is established.

To also verify that the communication is established, display the status at each end of the carrier by executing the **D S** and **D S D** commands on the MMI terminal. If MicroLink is up (carrier is good end-to-end), the communication across the link is established.

To display local carrier status:

CRI:: > D S	Display carrier status
CRI Remote IPE S/W L1105-A4 Software Version 1.00 8/11/95 10:45	
Local Site	Status at the local site
In Alarm Status: NO	No alarms detected
All Link Maps Normal	No link has been spared
Link 0 Alarm Level 0	Carrier 0 status
Link 1 Alarm Level 0	Carrier 1 status
Link 2 Alarm Level 0	Carrier 2 status

To display remote carrier status:

CRI::> D S D	Display distant carrier status
Distant End Ready	Distant end acknowledged
D S	Command received
CRI Remote IPE S/W R1105-B6 Software Version 1.00 8/11/95 10:45	
Remote Site	Status at the remote site
In Alarm Status: NO	No alarms detected
All Link Maps Normal	No link has been spared
Link 0 Alarm Level 0	Carrier 0 status
Link 1 Alarm Level 0	Carrier 1 status
Link 2 Alarm Level 0	Carrier 2 status

Table 15 lists MMI commands used to display and configure carrier parameters such as setting alarm thresholds, setting time and date, configuring carrier links, connecting to the SDI port, and testing the carriers and interfaces to the carrier link.

Table 15
MMI commands used in setting the carrier parameters

Command	Description
D C	Display configuration. Displays current configuration of the Local and Remote Carrier Interface cards.
D C D	Display configuration distant. Displays current configuration of distant Local and Remote Carrier Interface cards.
D S	Display status. Displays near-end carrier status.
D S D	Display status distant. Displays far-end carrier status.
L	Log into the MMI terminal when the system has one Local Carrier Interface card. The password is M1LINK.
L sl	Log into a specific superloop when the system has more than one Local Carrier Interface card daisy-chained in the network module. Refer to Figure 22 to see the path L (address). The password is M1LINK.
S A	Set carrier alarm threshold and duration parameters
S T	Set time or verify current time
S D	Set date or verify current date
S C	Set configuration
S N	Set site name and superloop
HOST or HO	Terminal in Host SDI mode. The password is HOST.
@@@	Terminates the Host SDI connection
T	Specifies a test from 1 to 5 to be run on the equipment
Q	Logs the terminal user out

To configure the carriers and specify carrier 2 as a spare carrier:

CRI > L	To login to the MMI terminal
Enter Password > M1LINK	Password is **M1LINK**
CRI:: >	Prompt requesting an MMI command
CRI::> S C	To set carrier parameters
Equipped carrier 0 (Yes or No) Y	Enable carrier 0. Enter Y to enable or N to disable.
Equipped carrier 1 (Yes or No) Y	Enable carrier 1.
Equipped carrier 2 (Yes or No) Y	To enable carrier 2
Enable #2 for Spare (Yes or No) Y	Defines carrier 2 as spare
Enable self clearing Alarms (Yes or No) Y	To enable/disable alarm clearing

To configure the carrier alarm thresholds. Defaults threshold values are set in the factory and should not be changed unless there is a good reason for doing so:

CRI:: >	Prompt requesting an MMI command
CRI::> S A	To set carrier alarm parameters

Alarm 1 Threshold: Current value E-6 New value E-6
Threshold Duration (in seconds) Min –1 Max – 3600 Current value 1

Alarm 2 Threshold: Current value E-5 New value E-5
Threshold Duration (in seconds) Min – 1 Max – 2148 Current value 1

Alarm 3 Threshold: Current value E-4 New value E-4
Threshold Duration (in seconds) Min – 1 Max – 218 Current value 1

Frame Slip Threshold (Min – 1 Max – 255) Current Value 255

Frame Slip Threshold Duration (in Hours) Min – 1 Max – 24 Current Value 1

Note: Threshold Duration parameter for BER thresholds should not be longer than 10 seconds to allow fast recovery of a faulty carrier when the bit error rate improves. For example, if the duration is set to one hour, a faulty carrier that starts operating correctly will wait one 1 hour before the alarm condition is cleared and the carrier becomes available for traffic again.

Parameter values explanation:

Alarm 0—No alarm, the carrier is operating without bit errors and without excessive out of frame. If carrier was previously spared it is automatically unspared.

Alarm 1—The alarm indicates a low bit error rate (BER maintenance threshold). The transmission continues without trying to spare this link. Carrier maintenance should be scheduled. The alarm LED comes ON.

Alarm 2—Bit error rate is high and the carrier is automatically spared if the spare carrier is available (BER No New Data Calls). Otherwise, the carrier continues to operate normally for voice calls but no new data calls are allowed on this carrier.

Alarm 3—Very high bit error rate (OOS: BER, LOF, LOS, Blue Alarm, Excessive Frame Slip). If the spare carrier is available, this faulty carrier will be spared. Otherwise, the carrier is placed out of service and all calls on this carrier are disconnected.

Alarm Threshold—Number of bipolar violation. E-6 represents 10^{-6} or 1 error in 1 million bits, E-5 represents 10^{-5} or 1 error in 100,000 bits, and E-4 represents 10^{-4} or 1 error in 10,000 bits.

Threshold duration— Carrier signal monitoring duration (1 second to 3600 seconds) to detect bipolar violation errors. The error counter is updated every second for the length of the threshold duration.

Frame Slip Threshold—Number of controlled carrier frame slips allowed in a given time duration. Preferred threshold is 255.

Frame Slip Threshold duration—Carrier frame synchronization monitoring duration (1 hour to 24 hours) to detect the number of frame slips specified by the Frame Slip Threshold. Preferred duration is 1 hour.

The fewer the bipolar violations and/or frame slips, the better the carrier link performance. Based on the frequency of errors and frame slips, the specified thresholds determine the occurrence of Alarm 1, Alarm 2, and Alarm 3.

Alarm Disable command If the Maintenance LED comes ON and stays ON, a possible cause may be that the Alarm Disable (A D) command has been executed, which causes this condition.

To configure time and date:

CRI:: >	Prompt requesting an MMI command
CRI::> S T	To set time
Current Time 10:06:14 *10:15:25* Current Time 10:15:25	Enter correct time at the cursor, if required.
CRI::> S D	To set date
Current Date 8/10/95 *18/11/95* Current Date 8/11/95	Enter correct date at the cursor, if required.
CRI::> S N	Set site name
Change Site Name (Yes or No) Y Enter Site Name SFO	Change name or add name if not previously entered.

Note: Time and date should be set correctly to allow correlation of the Carrier Remote Interface Alarm Log with error messages in the Meridian 1 History File.

Verifying carrier link connections at the remote site

When all the carriers are connected and equipped, all carrier alarm LEDs may be turned OFF and the signaling across the link will work even though there may be a mismatch in carrier link connection between the local and remote ends. However, the voice and data connections may not work due to the scrambling of the time slots, which are assigned to specific carriers and cannot be used by other carriers. However, Carrier Test 1 may not show any errors under these conditions.

Note: All carriers will show Out of Frame alarm if the Local Carrier Interface card faceplate ENB/DIS switch is set to DIS. Carrier clocking is enabled when the switch is set to ENB. Carrier alarms may clear even while the Local Carrier Interface card is not software enabled when the switch is set to ENB.

All equipped carriers have been previously connected and configured at the local site and the carrier circuit ID recorded for each link 0-2. All carrier facilities (carrier links) should have been installed and tested by the carrier network provider up to the demarcation point at both ends.

To insure that all equipped carrier links are connected to their corresponding I/O panel connectors at the remote site, you must identify, test, and tag each carrier link individually as follows:

1 Configure all equipped carrier links by executing the **S C** (Set Configuration) command. Any unused carrier links must be configured as "unequipped" to prevent the carrier alarm LED from being constantly ON. Configure carrier #2 as spare or primary (not spare). Default parameters should not be changed unless you have a good reason for changing them.
Execute the **D C** (Display Configuration) command to verify the configuration.

2 Identify the circuit ID for carrier #0 at the carrier network demarcation point and connect the corresponding patch cable to the I/O panel connector (8-pin modular jack) for carrier #0.

3 Observe the carrier alarm LEDs on the faceplate of the Remote Carrier Interface card. Initially carrier alarm LEDs for all equipped carrier links should be ON due to Loss-of-Signal. The LED for carrier #0 should be turned OFF approximately 10 seconds after the patch cable for the selected carrier #0 is plugged into the Remote Carrier Interface card I/O panel connector for carrier #0.
If a good quality signal is received by both the Remote Carrier Interface card and the Local Carrier Interface card on carrier #0, the link is installed in the appropriate I/O panel connectors at both ends. If the connection is mismatched (carrier #0 at one end connects to carrier #1 or #2 connectors at the other end), the alarm LED will remain ON.
The LED also remains ON if there is a carrier alarm on the Remote Carrier Interface card (near end), however, the LED is turned OFF if there is no carrier alarm on the Remote Carrier Interface card (near end) and communication cannot be established across the link due to alarm on the Local Carrier Interface card (distant end).
Distant end carrier alarms cause the near end LED to turn ON only if the Remote Carrier Interface card and Local Carrier Interface card can communicate.

4 Test the carrier 0 link by executing the carrier status commands (**D S**-display carrier status and **D S D**-display carrier stratus distant) using the MMI terminal. Compare the carrier status on both the Remote Carrier Interface card (near end) and the Local Carrier Interface card (far end). Refer to "Configuring the carriers" on page 153 to see the displays of these two MMI commands. There are four possible conditions:

- If the LED for carrier #0 is OFF and the Remote Carrier Interface card and Local Carrier Interface card have establish signaling communication, both ends will show "No Alarm" for carrier #0 and "Loss of Signal" for carrier #1 and carrier #2. No mismatch.
- If the LED for carrier #0 stays ON due to a mismatch, the Local Carrier Interface card (far end) will show "Loss of Signal" for carrier #0 and "No Alarm" for carrier #1 and carrier #2.
- If the LED for carrier #0 stays ON due to a carrier alarm condition on the Remote Carrier Interface card (near end), the **D S** command will show the type of carrier alarm on carrier #0, and the **D S D** command cannot retrieve the far end status.
- If the LED for carrier #0 Remote Carrier Interface card (near end) is OFF but the Remote Carrier Interface card and the Local Carrier Interface card cannot establish communication due to a carrier alarm condition on the Local Carrier Interface card (far end), the **D S** command will show "No Alarm" on the carrier #0 on the Remote Carrier Interface card (near end), and the **D S D** command cannot retrieve the far end status.

5 Disconnect the patch cable from the I/O panel connector for the carrier #0 that was just tested and repeat steps **1** through **5** for carrier #1 and carrier #2 as equipped before proceeding to step **6**.

6 Any carrier faults must be isolated and corrected. In case of mismatched carriers, the patch cables must be traced to the demarcation point at each end, and the carrier circuit IDs verified at both ends to determine which end of the carrier has been miswired or incorrectly identified.

7 After all carriers have been identified and labeled at the I/O panel connectors, they should all be plugged into the proper I/O panel connectors for the Remote Carrier Interface card and tested individually using the MMI Carrier Test 3 (Remote Loopback). Refer to Procedure 9 "Testing the carriers" on page 214.

The carrier links are now connected correctly. This will be further established during acceptance testing when the actual calls are made to verify the voice and data transmission across the carrier links.

Display current carrier equipment configuration

Before you conclude the installation and configuration of the Carrier Remote IPE, re-verify the configuration parameters and make sure that they are set properly.

To display the configuration parameters, execute the **D C** command on the MMI terminal. This is an example of what the MMI terminal may display:

CRI::> D C

CRI Remote IPE S/N L1105-A4 Software Version 1.00 8/17/95 10:48

Local Site (*Note*)

Alarm Enabled: YES Self Clearing Enabled: YES

Sparing Enabled/Disabled: Enabled

All Link Maps Normal

Alarm Level 1 Threshold Value E-6 Threshold Duration (in seconds) 1

Alarm Level 2 Threshold Value E-5 Threshold Duration (in seconds) 1

Alarm Level 3 Threshold Value E-4 Threshold Duration (in seconds) 1

Frame Slip Alarm Level Threshold 100 Threshold Duration (in hours) 2

Current DIP Switch S1 Settings (s1-s8) OFF OFF ON ON OFF ON ON OFF

Current DIP Switch S11 Settings (s1-s8) OFF OFF OFF ON ON OFF OFF OFF

Note: When the **D C** command is executed for the Carrier Remote IPE cabinet at the remote site, it displays "XSM Emulation Active".

Parameter values explanation:

Alarm Enabled—Alarm monitoring and logging is enabled. CRI messages are enabled.

Self Clearing Enabled—The alarm indicators (LED and external contact closure) will automatically clear when the operational alarm level is cleared.

Sparing Enabled/Disabled—Carrier 2 is enabled or disabled as a spare carrier.

All Link Maps are Normal—No link has been spared. This is always the case when carrier 2 is configured as a primary carrier link.

Alarm Threshold—Number of bipolar violations. E-6 represents 10^{-6} or 1 error in 1 million bits, E-5 represents 10^{-5} or 1 error in 100,000 bits, and E-4 represents 10^{-4} or 1 error in 10,000 bits.

Threshold duration—Carrier signal monitoring duration (1 second to 3600 seconds) to detect bit error rate (CRC and BIPV) exceeding threshold. The error counter is updated every second for the length of the threshold duration.

Frame Slip Threshold—Number of carrier frame slips allowed in a given time duration.

Frame Slip Threshold Duration—Carrier frame synchronization monitoring duration (1 hour to 24 hours) to detect the number of frame slips specified by the Frame Slip Threshold.

Current DIP Switch S1 and S11 Settings—Shows the setting of switch positions 1 through 8 for both SW1 and SW11 of the Local Carrier Interface card if you are displaying the local site or SW1 and SW11 of the Remote Carrier Interface card if you are displaying the remote site.

Carrier Remote IPE acceptance testing

Reference list

The following are the references in this section:

- *X11 input/output guide (553-3001-311)*

This section describes Carrier Remote IPE functional testing to verify that functions and features associated with the Carrier Remote IPE are operating correctly.

Overview

Acceptance testing is conducted after the system has been installed, is powered up, and appears to be functioning correctly, that is, all LEDs, displays, and system messages indicate that the system is operating correctly. The Carrier Remote IPE acceptance testing should be conducted after:

— a previously installed system is upgraded with Carrier Remote IPE equipment and generic software X11 Release 21 with REM_IPE 286 carrier software or higher and operates correctly without Carrier Remote IPE equipment

— a newly installed system with Carrier Remote IPE equipment using generic software X11 Release 21 with REM_IPE 286 carrier software or higher appears to operate correctly

Acceptance testing verifies the operation of system functions and features at the remote site equipped with the Carrier Remote IPE.

Acceptance testing consists of:

— checking the system

— preparing the system for testing

— testing system functions at the Carrier Remote IPE site

Checking the system

After Carrier Remote IPE equipment has been installed, carrier connections verified, and configured, you can visually inspect Carrier Remote IPE cards to make sure they are operating correctly by observing their LEDs:

— Execute the **D S** and **D S D** commands to check carrier alarm levels for each carrier at both the local and remote site. If all alarm levels are 0 at both ends, carrier links are operating correctly.

— Check the card LED located at the top of the Local Carrier Interface card faceplate. If the card LED on the Local Carrier Interface card is off, the card is operating correctly. If the card LED is on, the card is disabled or faulty. To enable the Local Carrier Interface card or to correct a problem, go to "Carrier Remote IPE fault isolation and correction" on page 198.

— Check carrier LEDs on the Local Carrier Interface card faceplate. If all LEDs are off, carriers are operating correctly. If one or more carrier LEDs are on, one or more carriers are faulty. If the amber LED is on, the card is in the maintenance state.

— Check the card LED located at the top of the Remote Carrier Interface card faceplate. If the card LED on the Remote Carrier Interface card is off, the card is enabled and operating correctly. If the card LED is on, the card is disabled or faulty. To enable the Remote Carrier Interface card or to correct a problem, go to "Carrier Remote IPE fault isolation and correction" on page 198.

— Check carrier LEDs on the Remote Carrier Interface card faceplate. If all LEDs are off, carriers are operating correctly. If one or more carrier LEDs are on, one or more carriers are faulty. If the amber LED is on, the card is in the maintenance state.

— Check the hexadecimal display on the Remote Carrier Interface card. Refer to the Appendix A to identify hexadecimal codes displayed by the Remote Carrier Interface card during self-test.

If the display and all indicator LEDs on Carrier Remote IPE equipment indicate good operating condition, the equipment is functional and you can proceed with setting up the necessary equipment for acceptance testing.

Setting up test conditions

To conduct acceptance testing, you must have a setup that can verify basic system functions and features initiated and terminated at the Carrier Remote IPE site. You may be able to use the system as configured at the site according to the customer requirements and not have to modify the configuration to perform the acceptance testing.

Configure carrier links with a spare link so that you can test the transfer of traffic from a primary link to the spare link.

To conduct the acceptance testing, make sure that each Carrier Remote IPE line card has at least one telephone connected to one of its subscriber loops. If possible, use some 2500 telephones to check the ringing generator and the DTMF operation. Also, make sure that a terminal is connected to the MMI port.

If you have Carrier Remote IPE main and expansion cabinets, install at least one line card in test card slots 0, 9, 10, and 15 of cabinets and connect at least one telephone to each line card subscriber loop.

Performing acceptance testing

Since functions and features at the Carrier Remote IPE site are identical to functions and features at the local system site, the main purpose of acceptance testing is to verify that the carrier equipment and the carrier links are functioning correctly. This can be accomplished by:

— performing basic voice calls

— using the MMI terminal to configure and maintain Carrier Remote IPE equipment

— checking the protection switching of carrier links when configured with one spare carrier link

Voice calls

A voice call can be established between two voice terminals across a network, between two terminals on the same PBX, and even between two terminals on the same line card.

Acceptance testing of Carrier Remote IPE voice calls is conducted when testing the following basic system features supported by telephone sets connected to subscriber loops at the remote site:

— placing a call to the remote site

— placing a call in call hold/call retrieve

Placing a call to the remote site

From the local system site, place a call to a Carrier Remote IPE site by dialing a remote station directory number (extension number).

> ***Note:*** The system treats Carrier Remote IPE subscriber loops as local loops, so you need to dial only the extension number to access that station.

To perform a call test:

1. From a terminal at the local system site, dial a terminal at the Carrier Remote IPE site and establish an active call connection.
2. Verify that voice transmission is established by talking with the person at the other terminal. Make sure the speech is clear in both directions.
3. Maintain the connection and ask the person at the remote site to test some basic calling features such as call hold/call retrieve.
4. Terminate the call.

Call hold/call retrieve

Call hold is used to place an active call on hold in order to answer an incoming call or place an outgoing call. After releasing an incoming or an outgoing call, you can retrieve the call on hold. For the Carrier Remote IPE main and expansion cabinets, establish calls from stations connected to the subscriber loops in the main and the expansion cabinets to verify the intercabinet cable connection.

To perform a call hold/call retrieve test:

1 From a terminal at the local system site, dial a terminal at the Carrier Remote IPE site and establish an active call connection.

2 Verify that voice transmission is established by talking with the person at the other terminal.

3 Press the Hold key at the remote site to place the active call on hold.

Note: To find out how to use the feature keys on different terminals, consult the user manual that is supplied with the terminal.

4 Place an outgoing call from the terminal at the remote site by dialing an idle terminal located at the local system site.

5 Complete this outgoing call by first checking the voice clarity in both directions and then hang up.

6 Have another terminal call you while the first call is still on hold.

7 Answer the incoming call and place it on hold.

8 Retrieve the call first held.

9 Complete the call and hang up.

10 Retrieve the second call on hold.

11 Complete the call and hang up.

You can repeat this test for terminals connected to different subscriber loops on the same card and different subscriber loops on different line cards in the Carrier Remote IPE module or cabinet. By making these calls you generate traffic, which will be shown in the traffic report.

Data calls

Use only one carrier link between the local and the remote sites. To verify that a call connection supports data calls and that when a carrier link is in Alarm Level 2 no new data calls will be allowed, follow the steps below:

1. From a computer or a data terminal at the remote site, access a terminal or computer at the local Meridian 1 site, or vice versa.
2. Transmit and receive data files in both directions. Open a transmitted file to verify its integrity.
3. Use the BERT set to insert bit errors into the carrier link transmitting data so it exceeds Alarm Level 2 threshold.
4. Since the sparing feature is not available, the carrier will continue to operate in Alarm Level 2 condition.
5. From a different data terminal attempt to establish a data call to a computer or terminal at the opposite side of the link.
6. The connection will not be established and the No New Data (NND) parameter on the display will show YES (yes no new data) for the carrier used, when you execute the **STAT** command in LD 32.
7. Remove the BERT set from the carrier link and retry the data call connection. Wait a few minutes or use the MMI command **C A** before retrying so that the carrier bit error monitor will determine that the cause of bit errors is no longer present. The data call will now be established because the bit error source has been removed and the Alarm Level is back to 0.
8. Verify the integrity of this data connection by checking the transmitted files.
9. Disconnect the data calls.

Checking the MMI terminal operation

Connect an MMI terminal to the Local Carrier Interface card at the local site and another MMI terminal at the Carrier Remote IPE site.

1 Set the current mode of the MMI terminal to the MMI mode by executing the **L <address>** command on the MMI terminal at the local system site. The Password is: **M1LINK.**

2 Check the status of the Local Carrier Interface card by executing the **D S [P]** command.

3 Check the status of the Remote Carrier Interface card by executing the **D S D [P]** command. This command is sent over the carrier link to the Remote Carrier Interface card for execution.

4 Check the log file content by executing the **D L [P]** command to display log messages from the file starting with the oldest message. Examine the messages.

Checking carrier link protection switching

To verify that the carrier link protection switching is operating correctly, conduct the following tests with carrier links:

— forced carrier failure (disconnect carrier link at the I/O panel)

— forced switchover

Note: This test can be conducted only when carrier 2 is configured as a spare carrier link.
If both carrier 0 and carrier 1 are faulty, carrier 0 will always have sparring priority over carrier 1.

Forced carrier failure switchover

To conduct this test:

1 Check the status of all three links by executing the **D S [P]** command from the MMI terminal. Make sure that the two primary and the spare links are functional without an alarm condition.

2 Establish a call from the Carrier Remote IPE to the local system site over carrier link 1. Refer to "Voice calls" on page 168 to establish the call.

3 Manually disable carrier link 1 by unplugging the link at the I/O panel. The call will be transferred to carrier link 2 (spare).

4 The call should continue to be established.

5 Manually disable carrier link 0 by unplugging the carrier cable at the I/O panel.

6 The spare link 2 should release carrier link 1 and spare carrier link 0.

Note: Carrier 0 has sparing priority over carrier link 1, therefore, when carrier 0 was disabled, the spare carrier 2 terminated carrier 1 sparing and established sparing of carrier 0.

7 Verify that the call is no longer established over the spare link (link 2), since the call was established over carrier 1, which has been dropped and is no longer spared. Execute the **STAT** command in LD 32 to show the sparing status.

8 Reconnect carrier link 0. As soon as carrier link 0 recovers and becomes operational, the spare carrier 2 will automatically spare carrier 1.

9 Reestablish the call over carrier link 1, which is now spared over carrier link 2.

10 Check and make sure that the call is established.

11 Reconnect carrier link 1 and wait until carrier 1 has reestablished communication. The established calls should continue to be connected over the carrier link 1.

12 Disconnect the call by hanging up the receiver on the telephone.

Removing the test setup

After acceptance testing has been completed and the results show that the system is operating correctly, you should remove the setup you used to conduct the testing and restore equipment according to the customer configuration.

If you used the actual customer configuration to perform these tests, you do not have to change or remove the setup.

Generating traffic reports

Use system traffic reports to identify calls made during acceptance testing to and from the Carrier Remote IPE site.

The system traffic network loop report TFS001 provides statistics on the number of timeslots used by each loop and the traffic over these loops as measured in CCS (hundred call-seconds).

For more information on traffic reports, refer to the Traffic control program LD 02 in *X11 input/output guide (553-3001-311).*

Carrier Remote IPE maintenance

Reference list

The following are the references in this section:

- *X11 features and services (553-3001-306)*
- *X11 input/output guide (553-3001-311)*
- *Meridian 1 general maintenance information (553-3001-500)*
- *Meridian 1 fault clearing (553-3001-510)*
- *Meridian 1 hardware replacement (553-3001-520)*

This section describes system maintenance tools and procedures to guide you in identifying Carrier Remote IPE faults, locating defective equipment, correcting problems by fixing or replacing defective equipment, and verifying the operation of Carrier Remote IPE after corrections or replacements have been made.

Maintenance overview

Carrier Remote IPE maintenance deals with two types of problems:

— installation

— operation

Installation problems are created during the installation of an entire Meridian 1 with the Carrier Remote IPE or during the addition of the Carrier Remote IPE to an existing system.

Operation problems occur when components fail or equipment is accidentally disconnected during normal system operation.

In either case, the problem identification should be approached systematically. A problem may have more than one cause. To isolate the cause, a knowledge of Carrier Remote IPE operation is required. This information can be found in the "Carrier Remote IPE product description" on page 13. Once the cause is identified, the problem can be corrected by replacing the defective card, connecting accidentally disconnected cables, or correcting the software problem.

The system provides built-in self-diagnostic indicators and software and hardware tools. These diagnostic facilities simplify system troubleshooting and reduce mean-time-to-repair (MTTR).

This document focuses on the maintenance of Carrier Remote IPE equipment at the remote site and in the system. It requires that system non-Carrier Remote IPE functions operate correctly before you start diagnosing Carrier Remote IPE problems. The system installation and maintenance guide documents: *Meridian 1 general maintenance information (553-3001-500)*, *Meridian 1 fault clearing (553-3001-510)*, and *Meridian 1 hardware replacement (553-3001-520)* describe how to maintain the entire system. This chapter describes how to maintain the Carrier Remote IPE equipment as an integral part of the system.

Diagnostic tools

Diagnostic tools are used to troubleshoot problems in the system including problems with the Carrier Remote IPE. When diagnosing Carrier Remote IPE problems, you may have to use more than one of these tools.

Hardware diagnostic tools

System hardware diagnostic tools consist of:

— card self-tests

— LED indicators

— display codes

— enable/disable switches

Self-test

A self-test is automatically performed by each Carrier Remote IPE card when you insert it into an operating system module, when you enable the card, or when you power up or reset the system. You can also perform a self-test on a card using software commands.

This test checks general card functions and determines if they are operating correctly. It is useful when you first install the cards because, upon insertion, the card automatically starts the self-test and gives you an immediate indication of its operating status.

LED indicators

System cards are equipped with red LED indicators and module power supplies are equipped with green LED indicators. These indicators show the status of each card or power supply.

Carrier Remote IPE LED indicators. Both the Local Carrier Interface card and the Remote Carrier Interface card have LED indicators on the front panel. These are:

Card LED—is a red LED that indicates the status of the card. If the LED is ON, the card may be faulty or disabled. When the card is powered up, it blinks three times during self-test if functioning correctly, otherwise it turns ON and stays ON. The LED turns OFF when the card is software enabled.

Carrier LEDs—each red carrier LED is OFF when the carrier is operating correctly or it is not equipped by the MMI command S C (Set Configuration). If the carrier is faulty at either end, the carrier LED will turn ON and stay ON until faults are corrected at both ends.

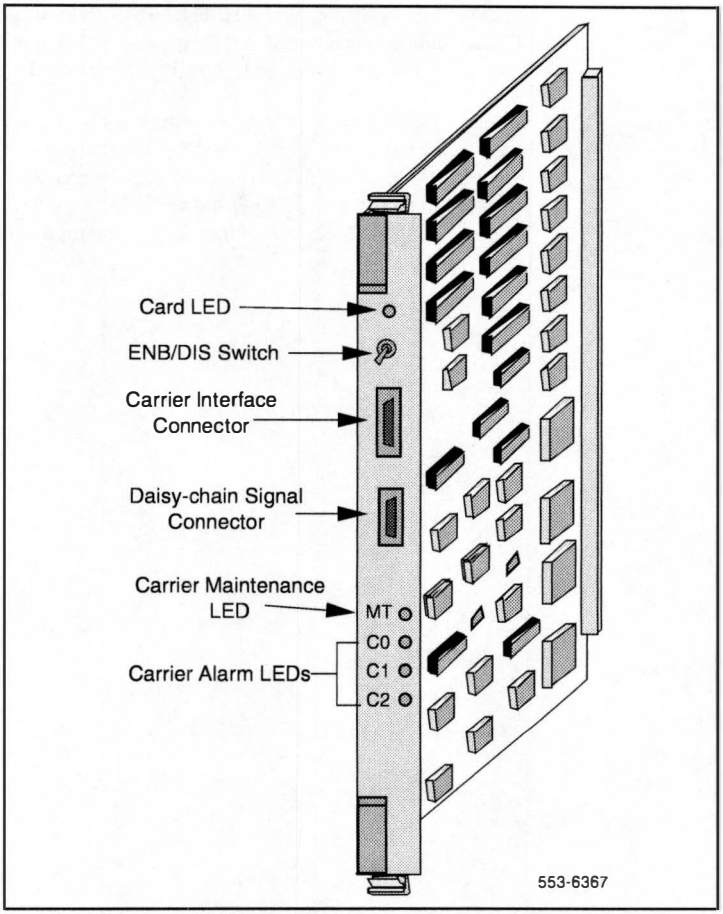
> *Note:* Far-end alarms are communicated across the link if the MicroLink is up i.e. a carrier is good end-to-end in both directions.

Maintenance LED—is an amber LED that turns ON when the card is in the maintenance mode, i.e., when carrier tests are running by the MMI command over a carrier, or when alarms are disabled by the MMI command **A D**, or when certain option DIP switches are set incorrectly (SW1, pos 2 that selects the LCI or RCI card).

Carrier Remote IPE issues a local alarm (CRI1nnn) when a major alarm occurs at the local system site and a remote alarm (CRI2nnn) when a major alarm occurs at the Carrier Remote IPE site. In either case, the LED indicating the alarm turns red. These alarms are printed on the TTY or displayed on the maintenance terminal.

Figure 23 shows the Local Carrier Interface card. It also shows the card LED that indicates the status of the Local Carrier Interface card and each carrier link.

Figure 23
NT7R51 Local Carrier Interface card



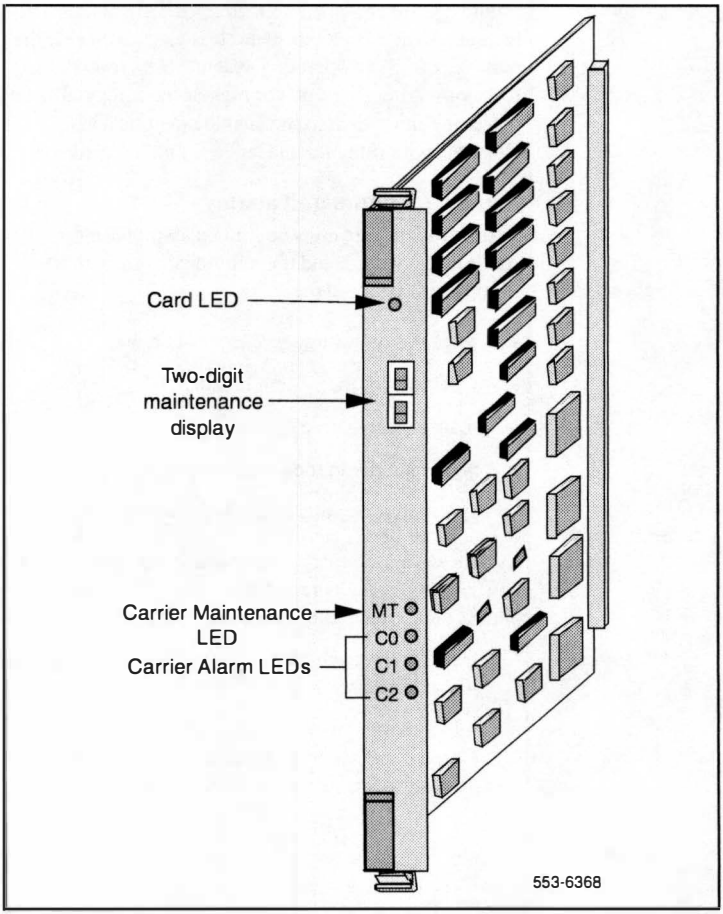
Display codes

Some system cards, such as the Remote Carrier Interface card, are equipped with an alphanumeric display on the faceplate.

Codes displayed on the common equipment cards are logged into a history file and can be printed and reviewed to analyze the sequence of events leading to the presently displayed status. The last 16 codes displayed by the Remote Carrier Interface card are stored in memory and can be reviewed and then cleared by using Network and Signaling Diagnostic Program LD 30.

Figure 24 shows two seven-segment displays on the faceplate of the Remote Carrier Interface card. They are used to automatically display the card status and identify possible faults with the card. These codes are displayed in hexadecimal notation and are listed and interpreted in Appendix A: "System messages" on page 221 and in the *X11 input/output guide (553-3001-311)*.

Figure 24
Remote Carrier Interface card



Enable/disable switch

Some system cards, such as the Local Carrier Interface card shown in Figure 23, are equipped with an ENB/DIS switch. This ENB/DIS switch is located on the card's faceplate. It is used to disable the card before you remove it from an operating system without disrupting other system functions. After you repair or replace the card, you can place it back in service by setting the switch to the enable position. This switch enables carrier clocking even if the Local Carrier Interface card is not software enabled.

System monitors and alarms

System monitoring units continuously monitor the environmental and power status of the system and the individual system modules including the Carrier Remote IPE equipment.

The system monitor issues alarms when the:

— CPU fails or the system reloads

— main power source is lost

— power supply in the modules fails

— system temperature exceeds limits due to blower or fan failure

System alarms are categorized for alerting and maintenance action on the type and severity of faults reported by the system monitors and indicators. These alarms are divided into:

— major alarms, which indicate serious system problems that require your immediate attention

— minor alarms, which indicate isolated faults relative to a limited number of call connection problems that do not require your immediate attention

Software diagnostic tools

System software diagnostic tools are used to monitor the system status, provide the ability to test various system functions and equipment suspected of being faulty, and log and display system fault history. Diagnostic tools are:

— resident diagnostic programs

— interactive nonresident diagnostic programs

— history file

— user reports

Resident programs

System resident programs are diagnostic and administration programs that continuously monitor system operation and report faults and generate system messages, which are displayed on the system terminal or printed on a system printer. These system messages are listed in the *X11 input/output guide (553-3001-311).*

These messages are:

— maintenance display codes listed under HEX that indicate status and error conditions in the system

— maintenance messages (CRInnnn) listed in Appendix A: "System messages" on page 221 and reported to the terminal over the Meridian 1 maintenance TTY that indicate status and faults with Carrier Remote IPE equipment

— error messages listed under SCH and ERR that indicate hardware faults and under BUG that indicate software faults

— overload messages (OVDnnn) that indicate faulty peripheral cards listed under OVD

— error messages listed under PWR that indicate power faults detected by system monitors or Remote Carrier Interface cards at remote sites

— a fault history file that can be printed and reviewed to identify fault events leading to the present status

Resident administration programs provide automatic system administration routines that facilitate system initialization and fault recovery.

These programs are:

— an overlay loader program that finds, loads, and executes all nonresident programs selected to run as midnight and background routines

— a system loader program that downloads the call processing programs and starts main memory checking when executing sysload

— a system initialization program that automatically starts after the system loader program completes the downloading process and outputs the initialization messages listed under INI in the *X11 input/output guide (553-3001-311)*

— a peripheral software download program that downloads loadware to the Local and Remote Carrier Interface cards

Nonresident programs

Nonresident programs can be interactive or automatically executed programs. These programs are stored on the system hard disk or floppy disks and are downloaded by the overlay loader program to system memory on demand or at a predetermined time of day such as for midnight and background routines testing.

You can access interactive programs through a maintenance terminal or a maintenance telephone, as described in this chapter. These programs are used to:

— test the equipment and place lines and trunks out of service when testing or faulty, and back in service when testing is completed or the line or trunk has been repaired or replaced

— verify the status of a fault

— verify that a fault has been corrected and the equipment is operating correctly

You can select a number of nonresident diagnostic programs by using Configuration Record Program LD 17. This is a program that selects other diagnostic programs and executes them automatically as midnight and background routines. These programs test the entire system and print a report that lists all the test results.

You can also manually select continuity tests that check continuity between the Local Carrier Interface card and the Remote Carrier Interface card, as well as other network and peripheral controller cards. You can specify these tests in Background Signaling and Switching Diagnostics LD 45 and Network and PE Diagnostic Program LD 32.

History file

The system can be equipped with the history file feature, which allows the system to store events such as:

— service changes

— maintenance messages

— software errors

— initialization and system download messages

— traffic messages

These messages can be printed and analyzed to identify the events that led to the present status. You can select the type of messages you wish to store. For information on how to select messages to be logged into the history file, refer to *X11 features and services (553-3001-306)*.

User reports

User-reported faults may give you a clue of what failed in the system. These are:

— major alarms reported by attendant

— no ringing or no dial tone

— trouble with calls in specific Carrier Remote IPE modules

— trouble with specific terminals

— cannot transfer calls, etc.

Local and Remote Carrier Interface cards system maintenance commands

Local Carrier Interface card and Remote Carrier Interface card maintenance commands are identical to the standard NT8D04 Superloop Network and NT8D01 Peripheral Controller cards. These commands are used to manipulate the operational status and perform diagnostic tests on these cards. These commands are located in Network and PE Diagnostic LD 32, which can be accessed using the administration terminal or the maintenance telephone.

Table 16 lists carrier-related superloop maintenance commands provided by Network and PE Diagnostic LD 32. The full list of LD 32 commands is described in the *X11 input/output guide (553-3001-311)*. Detailed output of maintenance commands is explained in various maintenance procedures in this chapter.

Table 16
System carrier superloop maintenance commands

Command	Response	Description
DISL sl	Prompt	Disables a specific superloop
ENLL sl	OK and prompt	Enables a specific superloop
STAT sl	listing and prompt	Displays status for one or all network loops. Shows carrier alarm status, number of idle time slots per carrier, type of carrier (T1/E1), No-New-Data status, and sparing status
IDC sl		Displays the Local Carrier Interface card ID, the superloop number, and the corresponding Remote Carrier Interface card ID
	LCRI VERS=xxx FW IS SANE	Local Carrier Interface card xxx= loadware version
	aaaaaaaaaaa	Content of the LCI card ID in the EEPROM.
	XPEC VERS=xxx FW IS SANE	Remote Carrier Interface card xxx= loadware version
	aaaaaaaaaaa	Content of the RCI card ID in the EEPROM
XPEC	nn	Maps RCI (Peripheral Controller) to LCI (carrier superloop) and shows software status of the RCI (Peripheral Controller)
SUPL	nnn	Maps LCI (carrier superloop) to RCI (Peripheral Controller)

Table 17 lists carrier-related test commands provided by Background Signaling and Switching Program LD 45. The full list of LD 45 commands is described in the *X11 input/output guide (553-3001-311)*.

Table 17
System carrier test command in LD 45

Command	Response	Description
TEST		Enter the test number of the test you wish to run XCON 1 to 10.
		SL (superloop) or CR (carrier) to specify the entire superloop or just a carrier remote loop.
	PATT	Pattern (0 to 7)
	TYPG	N or P, where N= Local Carrier Interface and P= Remote Carrier Interface, is the pattern generator.
	SLOT	If TYPE SL was selected, the SLOT_STD prompt is automatically displayed. The user can then use the preexisting timeslot mapping or carriage return. If TYPE SL was selected to be a carrier, the SLOT_CARR is displayed. The user can use timeslot mapping as follows: For E1 carrier configuration use Timeslots 5 to 31 for Carrier 0 Timeslots 37 to 63 for Carrier 1 Timeslots 69 to 95 for Carrier 2 For T1 carrier configuration use Timeslots 5 to 25 for Carrier 0 Timeslots 37 to 57 for Carrier 1 Timeslots 69 to 89 for Carrier 2
	TAG	Tag number from 0 to 15 is assigned by the system.

Carrier Remote IPE MMI maintenance commands

The Local Carrier Interface card and Remote Carrier Interface card provide a man-machine interface (MMI) port to connect to a TTY or a configuration and maintenance terminal. Through this terminal you can directly issue commands to test and maintain system carrier equipment including the carrier links.

Table 18 lists MMI commands that are directly issued to the system over MMI terminals, which are connected to the Local Carrier Interface card MMI port and the Remote Carrier Interface card MMI port. When entering MMI commands, separate the command letters with spaces (A space D) and [P] indicates a pause. Detailed output of maintenance commands is explained in various maintenance procedures in this chapter.

Table 18
MMI commands (Part 1 of 2)

Command	Description
A D	Alarm disable. Disables all local and remote carrier alarms. Maint LED lit.
A E	Alarm enable. Enables all local and remote carrier alarms.
C A	Clear alarm. Clears all local and remote carrier alarms.
C A L	Clear alarm log. Clears near-end alarm log.
C A L D	Clear alarm log distant. Clears far-end alarm log.
C E	Clear error. Clears local and remote error counters for a all carriers.
C E D	Clear error distant. Clears a far-end error counter for all carriers.
D A L [P]	Display alarm log [pause]. Displays near-end alarm log with pause at full screen.
D A D [P]	Display alarm log distant [pause]. Displays far-end alarm log with pause at full screen.
D C	Display configuration. Displays current configuration of the Local and Remote Carrier Interface cards.
D H [P]	Display history [pause]. Displays near-end performance counters for a specified carrier for the last 24 hours with full screen pause.

Table 18
MMI commands (Part 2 of 2)

Command	Description
D H D [P]	Display history distant [pause]. Displays far-end performance counters for a specified carrier for the last 24 hours with full screen pause.
D P	Display performance. Displays near-end performance counters for a specified carrier for the current hour.
D P D	Display performance distant. Displays far-end performance counters for a specified carrier for the current hour.
D S	Display status. Displays near-end carrier status.
D S D	Display status distant. Displays far-end carrier status.
HE or ?	Help. Displays the help screen.
HOST	Connect the SDI port. Connects to the SDI port and @@@ terminates the connection. The password is **HOST.**
L	Log in. Logs into the MMI terminal when the system has one Local Carrier Interface card. The password is **M1LINK**. ***Note:*** If logged in and you type **L** and an incorrect password, it will log you out.
L sl	Log superloop. Logs into a specific superloop when the system has more than one Local Carrier Interface card daisy-chained in the network module. The password is **M1LINK**.
Q	Quit. Logs the terminal user out.
S A	Set alarms. Set carrier alarm threshold and duration parameters.
S C	Sets carrier configuration such as equipped/unequipped, automatic clearing of LED alarm indications, and carrier sparing.
S D	Set date. Set date or verify current date.
S T	Set time. Set time or verify current time.
@@@	Terminate the terminal connection.
T	Test. Specifies a test from 1 to 5 to be run on the specified carrier link.
T D	Test distant. A test from 1 through 5 conducted from the far-end.

Using system maintenance programs

To use system maintenance programs, you must access the system using a maintenance terminal or maintenance telephone.

Logging in on the maintenance terminal

To access the program, you must enter a valid password. To do this, type **LOGI** and press the Enter key. The following appears:

```
PASS?
```

Type your password and press the Enter key. Cursor will be moving without showing characters as you type your password. If you see

```
OVL015
>
```

you entered an invalid password. Type your password again and press the Enter key. If you entered a valid password, you will see

```
>
```

This means you are logged in. You are now communicating with Meridianþ I and can access the program.

Accessing the program

To access any program on the system, type LD followed by a space and the program number after the **>** prompt and press the Enter key.

For example, to access Network and PE Diagnostic Program LD 32, type **LD 32** after the **>** prompt and press the Enter key. At the prompt, type the command you wish to execute.

If, for example, you wish to enable network superloop #4 which is supported by a Local Carrier Interface card, at the prompt type the following:

```
.ENLL 4
```

This command will attempt to enable the Local Carrier Interface card supporting network superloop 4.

Responding to error messages

If you enter incorrect information after a prompt, the program displays a warning message or an error message. The prompt is displayed again below the error message so you can enter the correct information.

Exiting the program

To exit the program, type **** and press the Enter key. You see

```
>
```

This means you have successfully exited the program. Now you can either access another program or log out.

Logging out

After you exit the program, you should log out. To do this, type **LOGO** at the > prompt and press the Enter key.

Logging in and using a maintenance telephone

You can use a telephone as a maintenance terminal if you define its class of service as MTA (maintenance set allowed) in Telephone Set Program LD 11. This feature allows you to access diagnostic programs in the system and execute a limited set of maintenance commands to test system functions.

To enter commands on a maintenance telephone, you use its keypad. The numbers on the keypad represent numbers and letters that you normally use on a video display terminal keyboard.

Table 19 shows the translation from a terminal keyboard to a telephone keypad.

Table 19
Keyboard to keypad translation table

Terminal keyboard				Telephone key pad
			1	1
A	B	C	2	2
D	E	F	3	3
G	H	I	4	4
J	K	L	5	5
M	N	O	6	6
P	R	S	7	7
T	U	V	8	8
W	X	Y	9	9
			0	0
			Space or #	#
			Return	##

To use a diagnostic program on the system:

1 Press the prime DN key.

2 Place the telephone in the maintenance mode by entering **xxxx91** on the keypad, where **xxxx** is the customer's special prefix number (SPRE) as defined in LD 15. Normally xxxx is 1, thus you would enter **191**.

3 Enter ** to check if the communication link is idle.

4 If you detect a busy tone, the system is in session with another maintenance or administration terminal. Enter **** to force the other terminal to log out. If you do not detect a busy tone, the system is idle and you can automatically access the system.

5 Enter **53#xx##** to load a diagnostic program, where **xx** is the program number. For example, to load Network and PE Diagnostic Program LD 32, enter **53#32##**.

6 Perform the maintenance tasks by executing the maintenance commands resident in the program you loaded. For example, from Network and PE Diagnostic Program LD 32 you can disable a network loop by executing **DISL loop**, where loop is the Local Carrier Interface card loop, say 3. To execute this command enter **3475#3##** on the keypad.

7 Press the Release key to log out.

Isolating and correcting faults

Now that you are familiar with the troubleshooting tools, you can begin troubleshooting Carrier Remote IPE equipment. Based on whether Carrier Remote IPE equipment has just been installed and is not yet operational or it had been operating correctly and is now faulty, you can determine what may be the most probable cause of failure.

Type of faults

Problems can occur in the following areas:

— hardware

— configuration

— software

The type of faults that you have to isolate and correct depends on whether faults occur during installation or due to component failure in a previously operating system. For example, in a newly installed system the fault may be in any or all of the three areas. However, in a previously operating system the fault will probably be in the hardware.

Fault isolation steps

The following steps show you how to isolate system and Carrier Remote IPE faults using the diagnostic tools described in this chapter:

1 Observe and list the problem symptoms the system is exhibiting. Typical symptoms can be: the Local Carrier Interface card or Remote Carrier Interface card has its red LEDs turned on the Remote Carrier Interface card faceplate display shows a fault code, some common equipment or power supplies have their green LEDs turned off, some of the common equipment or network cards display codes that indicate faults, and so on.

2 Note if Carrier Remote IPE was just installed and has not been operating, or if it has been operating correctly and is now faulty. Based on this, refer to "Newly installed Carrier Remote IPE" below for lists of the most common problems.

3 Take the action recommended by the fault isolation and correction tables, which guide you through fault isolation steps and recommend what test procedures to use.

4 If after following the diagnostic procedures Carrier Remote IPE still does not operate correctly, contact your field service representative.

Newly installed Carrier Remote IPE

Problems that occur during the installation of an entire system including the Carrier Remote IPE are usually caused by:

— improperly installed cards

— loose or improperly connected external communication cables, internal cables, or carrier link cables

— incorrect software version

— incorrect Carrier Remote IPE configuration

These types of problems can also occur when:

— installing additional Carrier Remote IPE equipment into an already operating system

— installing a new software version or changing the Carrier Remote IPE configuration

Check the symptoms listed in Table 21 that are related to problems with a newly installed Carrier Remote IPE.

Previously operating Carrier Remote IPE

Problems that occur during the normal operation of Carrier Remote IPE are usually caused by:

— faulty equipment

— accidental disconnection of cables

— improper environmental conditions

Check the symptoms listed in Table 21 that are related to problems with a previously operating Carrier Remote IPE.

System fault isolation and correction

To isolate Carrier Remote IPE faults in the system, you must first isolate and correct the common, network, and power equipment faults to make the system non-Carrier Remote IPE functions operational. You can then proceed with fault isolation and fault correction of Carrier Remote IPE functions.

To aid you in isolating the problems in a systematic way, use the fault isolation and correction tables. These tables guide you through logical steps to determine the cause of the problem based on the visual fault indicators and system fault messages that you see.

Table 20 lists system problem symptoms, diagnosis of the problem based on the observed symptoms, and a recommended solution to the problem.

Table 20
System common and network equipment problems

Symptoms	Diagnosis	Solution
Green LED on the power equipment is off.	Power source lost, power defective, or disconnected power cables.	Check the power source, circuit breakers, and power cables. Refer to *Meridian 1 fault clearing (553-3001-510)* to correct the problem.
Maintenance terminal displays PWRxxxx messages.	Power supply, Power Distribution Unit, or Blower/Fan unit defective.	Refer to *X11 input/output guide (553-3001-311)* for a list of PWR messages. Based on the message, take the appropriate action to resolve the problem.
Some red LEDs on the common, network, and/or peripheral equipment are on and call processing has stopped.	Common or network equipment cards faulty. Peripheral equipment cards faulty.	Observe the error messages on the terminal and check for ERR and/or BUG messages listed in *X11 input/output guide (553-3001-311)*. Use this information to locate and correct the fault. Refer to *Meridian 1 fault clearing (553-3001-510)*.
Maintenance terminal displays OVDxxxx messages.	Excessive input messages from IPE cards, peripheral signaling card, network cards, and/or IPE cabling.	Observe the OVD messages on the terminal and check the description of these messages listed in *X11 input/output guide (553-3001-311)*. Use this information to locate and correct the fault. Refer to *Meridian 1 fault clearing (553-3001-510)*.
Maintenance display codes on the CPU cards and storage devices show fault codes.	Common equipment disk drive hardware faults, memory faults, or interrupt faults.	Refer to *X11 input/output guide (553-3001-311)* for a list of all the HEX codes. Based on the maintenance display codes description, take the appropriate action and resolve the problem.
Maintenance display codes on network cards show faults.	Indicates bus error or card problem.	Reinsert the card and observe the self-test codes. Refer to *X11 input/output guide (553-3001-311)* for a list of all self-test codes and their description. If the problem remains, replace the card.
Major or minor alarms.	Common, network, and/or peripheral equipment failure.	Refer to *Meridian 1 fault clearing (553-3001-510)* to identify the cause of alarm. Check the history file.

After you isolated and corrected common equipment and network equipment faults, all the other system and card faults may clear and the system may start operating normally. If this does not occur, you must proceed with troubleshooting Carrier Remote IPE equipment as described in "Remote Carrier Interface card fault isolation and correction" on page 207.

If you cannot resolve the problem after exhausting all the available diagnostic tools and test procedures, make a list of all the symptoms you observed and contact your field service representative.

Carrier Remote IPE fault isolation and correction

After non-Carrier Remote IPE system functions are operating correctly, you can proceed with fault isolation and fault correction of Carrier Remote IPE equipment.

If you cannot resolve the problem after exhausting all available diagnostic tools and test procedures, make a list of all the symptoms you observed and contact your field service representative. Refer to Table 22 on page 221 in Appendix A to identify the HEX codes that indicate possible problems with the Carrier Remote IPE.

Table 21 deals specifically with Carrier Remote IPE service problems. To diagnose these problems, the table refers you to the test procedures in this manual that will most likely be able to resolve these problems based on the symptoms these problems are exhibiting.

Table 21
Carrier Remote IPE equipment problems (Part 1 of 2)

Symptoms	Diagnosis	Solution
Red card LED on the Local Carrier Interface or Remote Carrier Interface is permanently on.	Card is disabled or faulty.	Go to *Procedures 1, 2,* and *4* in this chapter to check the card status and perform self-test. Also go to *Procedure 7* to check the carrier status using the MMI terminal commands.
Carrier LEDs show alarm condition.	One or more carrier alarm LEDs are on. No activity on the carrier.	Alarm Level 2 or 3. Alarm Level 2 allows voice calls but no new data calls on the carrier. Check carrier link connections and go to *Procedure 3* to test the link using the loopback test.

Table 21
Carrier Remote IPE equipment problems (Part 2 of 2)

Symptoms	Diagnosis	Solution
Carrier link is OK but remote TTY cannot access system.	Protocol not set properly or terminal not in SDI mode.	Check the protocol setup and make sure the MMI terminal is in the host SDI mode.
No communication with the system monitor.	System monitor address incorrect.	Observe the system messages on the MMI terminal and check the description of these messages listed in Appendix A. Use this information to locate and correct the fault.
Display on the Remote Carrier Interface card shows fault codes.	Card faulty, failed self-test or problem communicating with peripheral equipment.	Go to *Procedures 4* and *5* to check tracking and loopback. Also refer to *X11 input/output guide (553-3001-311)* for a list of codes. Based on the maintenance display codes description, take the appropriate action and resolve the problem.
Error messages printed on the MMI terminal or the Meridian 1 TTY.	Hardware or software problems with the Carrier Remote IPE.	Note various error messages. Refer to Appendix A and *X11 input/output guide (553-3001-311)* for a list of these messages and their description. Based on the code's description, take the appropriate action to resolve the problem.
Signaling works but no talk path.	Carriers are crossed over. External loopback left in place no end-to-end connection.	Check each carrier and make sure they are not crossed over. Refer to "Connecting the carrier link to the Remote IPE module" on page 127. Remove the external loopback.
Amber maintenance LED is on.	Test is performed over one or more carrier in the link. Alarms disabled. SW1 position 2 set wrong.	Wait until the test is completed and analyze the test data. Enable the alarms. Set SW1 position 2 correctly.
Near and far end Alarm Level 2 or Alarm Level 3.	Carrier network, and/or peripheral equipment failure.	Query the alarm status on carrier links by entering the **D A L [P]** command to display the near-end log file and **D A D [P]** to display the far-end log file. Check alarm settings with **D C** command.
Messages corrupted (ERR080).	Hardware problems.	Check Procedures 1 through 5.

Local Carrier Interface card fault isolation and correction

The Local Carrier Interface card provides a communication interface between the CPU and the Remote Carrier Interface card.

The Local Carrier Interface card processes signaling information and data received from the Remote Carrier Interface card over the carrier link.

Problems with the Local Carrier Interface card may be caused by hardware faults, incorrect configuration, a disabled Local Carrier Interface card, or continuity problems between the card and other network cards connected to the network bus. To isolate and correct the Local Carrier Interface card-related problems, follow Procedures 1, 2, and 3.

Procedure 1
Checking the Local Carrier Interface card status

The diagnosis in Table 21 indicates that the Local Carrier Interface card may be faulty or disabled. The first step in identifying the problem is to verify the status of the Local Carrier Interface card. The status of a Local Carrier Interface card is obtained by executing the **STAT sl** command in Maintenance and Diagnostic Program LD 32.

To obtain the Local Carrier Interface card status:

1 Log in on the maintenance terminal as described in "Using system maintenance programs" on page 191.

2 At the > prompt, type **LD 32** and press the Enter key to access the Maintenance and Diagnostic Program LD 32.

3 Type **STAT sl** and press the Enter key, where **sl** is the superloop number. It shows the highest alarm value of both cards you are checking. The far-end alarm does not show at the near end.

LD 32
NPR000
STAT sl

CARR	CALS	TTSA	NND	SPARED
0	0	21/21	NO	N/A
1	0	21/21	NO	N/A
2	0	21/21	NO	N/A

Note: This example shows 3 primary carriers and no spare, all carriers without alarm, and are available for New Data Calls. No calls in progress.

LD 32
NPR000
STAT sl

CARR	CALS	TTSA	NND	SPARED
0	3	0/21	YES	N/A
1	0	21/21	NO	N/A
2	0	21/21	NO	N/A

Note: This example shows 3 primary carriers and no spare, carrier 0 in los-of-signal (LOS) fault status.

LD 32
NPR000
STAT sl

CARR	CALS	TTSA	NND	SPARED
0	0	21/21	NO	NOT SPARED
1	0	21/21	NO	NOT SPARED
2	0	N/A	N/A	AVAIL

Note: This example shows 3 carriers equipped, carrier 2 is spared and available, and are available for New Data Calls. No calls in progress.

LD 32
NPR000
STAT sl

CARR	CALS	TTSA	NND	SPARED
0	3	21/21	NO	SPARED
1	0	0/21	YES	NOR SPARED
2	0	N/A	N/A	SPARING FOR 0

Note: Carrier 1 unequipped and carrier 2 sparing for carrier 0.

Parameter description:
CARR—Carriers 0, 1, and 2
CALS—Carrier alarm status (0 means that the Alarm Level is 0–no alarm)
TTSA—Timeslots currently available for voice and data
Carrier 0 superloop timeslots (5 to 25) for T1 and (5 to 31) for E1
Carrier 1 superloop timeslots (37 to 57) for T1 and (37 to 63) for E1 carriers
Carrier 2 superloop timeslots (69 to 89) for T1 and (69 to 95) for E1 carriers
NND—No New Data calls. (NO–indicates new data calls are not disallowed) i.e. MCAs may originate or terminate new data calls
SPARED—Indicates if a carrier is spared by carrier 2. N/A indicates that carrier 2 is equipped as a primary not a spare carrier.

If carrier 2 is configured as a spare, the traffic will be handled by carrier 0 and carrier 1 reducing the traffic capacity to 2/3, but by providing a spare, established calls are protected if one of the primary carrier links fails.

Note: If overload conditions are indicated by OVDxxx messages. Refer to *X11 input/output guide (553-3001-311)* for the message description and indication of the problem.

If the message indicates that the Local Carrier Interface card is faulty, replace the card.

Procedure 2
Performing the Local Carrier Interface card self-test

If the Local Carrier Interface card is faulty, you should conduct the self-test to verify that it is actually faulty before you replace it. This test verifies the basic Local Carrier Interface card functions and outputs a fail or pass message after the test is completed.

To start the self-test:

1 Log in on the maintenance terminal as described in "Using system maintenance programs" on page 191.

2 At the > prompt, type **LD 32** and press the Enter key to access the Network and PE Diagnostic Program.

3 Type **DISL sl** and press the Enter key to disable the Local Carrier Interface card, where **sl** is the Local Carrier Interface card superloop number you are disabling.

4 Type **XNTT sl** and press the Enter key to start the self-test, where **sl** is the Local Carrier Interface card superloop number specified for self-test.

If the response is:

TEST PASSED

the Local Carrier Interface card passed the self-test and is functional but must be enabled to turn off the red LED and become active.

If the Local Carrier Interface card passed the self-test, but the problem persists, the carrier link or other cards that interface with the Local Carrier Interface card may be faulty. To verify the integrity of the network bus and connections between the Local Carrier Interface card and other network and peripheral equipment cards interfacing with the Local Carrier Interface card, go to Procedure 3.

If the response is:

TEST FAILED REASON: xxxx

XPEC NOT CONNECTED

the Local Carrier Interface card failed the self-test and is faulty, where **xxxx** can be one of the following values:

0–ROM checksum failed
1–FLASH checksum failed
2–A21 #1 faulty
3–A21 #2 faulty
4–R71 faulty

Replace the Local Carrier Interface card as described in "Removing and replacing a Local Carrier Interface card" on page 218. NPRxxx message may be displayed as a result of a command-activated self-test if the Local Carrier Interface card is missing, not configured, and so on.

5 Exit LD 32 by typing ******** at the prompt.

Procedure 3
Performing the Local Carrier Interface system loopback tests

If the Local Carrier Interface card self-test indicates that the card is not faulty, you should conduct loopback tests to isolate the problem that may exist on network cards, network buses, or carrier link connections between the Local Carrier Interface card and the Remote Carrier Interface card.

The system loopback test is not service interrupting. However, if carrier 2 is not a spare carrier but an primary carrier, the system may respond with error message BSD202 if TEST ALL command is executed in LD 45. To avoid this problem, do not perform the TEST command manually on the system that has one or more Carrier Remote superloops with carrier #2 configured as an active carrier.

Loopback tests check the continuity between various interface points in the system. This is performed by sending a known signal pattern from the originating point to the destination and receiving it back at the originating point or a designated detecting point. If the pattern is detected and it matches the transmitted pattern without errors, the test verifies that the tested equipment and their connections are operating correctly. However, if the pattern is not detected or it is detected with errors, the equipment or the connections between the equipment are faulty.

The difference between loopback tests for the Carrier Remote IPE and the Superloop Network and Peripheral Controller cards is the selection of specific timeslots that have to be assigned for the Carrier Remote IPE loopback testing.

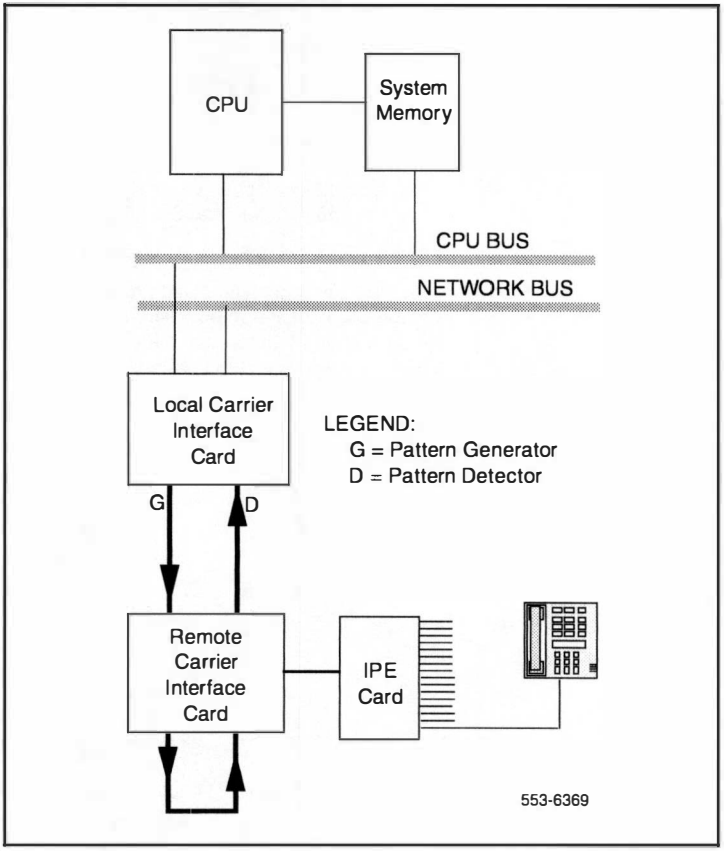
The system loopback test also tests the superloop network switching functions and the peripheral controller loopback functions on the Local Carrier Interface card and the Remote Carrier Interface motherboards respectively. Where, the on-line test 1, using the MMI command, tests the loopback between the daughterboards of these two cards.

The loopback uses the Local Carrier Interface card as a pattern generator and detector. For example, the signal is transmitted by the Local Carrier Interface card to the Remote Carrier Interface card and looped back to the Local Carrier Interface card over the carrier links.

> ***Note:*** For a Carrier Remote IPE with a spare link, the loopback is automatically routed over the functioning carrier link, not the faulty link. To identify the carrier that may be faulty, you can perform the carrier test at each end of the link by following the instructions in step 4 of this procedure.

Figure 25 illustrates the loopback path and shows the Local Carrier Interface card as a test pattern generator and detector.

Figure 25
Loopback path for XCON test 6



To start the loopback test:

1 Log in on the maintenance terminal as described in "Using system maintenance programs" on page 191.

2 At the > prompt, type **LD 45** and press the Enter key to access the Background Signaling and Switching Program.

3 Select test condition:

— Enter XCON 0 and press the Enter key if you wish to perform only one loopback test.

— Enter one test period shown in XCON H 1-255, M 1-255, Sþ1-255 and press the Enter key to select continuous loopback testing for a selected time span, where Hþ1-255 is 1 to 255 hours, M 1-255 is 1 to 255 minutes, and S 1-255 is 1 to 255 seconds.

Example: XCON M 5 specifies the duration of the test to be 5þminutes.

4 At the TEST prompt, type **6** and press the Enter key to test the loop from the Local Carrier Interface card through the carrier link and the Remote Carrier Interface card back to the Local Carrier Interface card. Continue responding to the prompts to configure the loopback test as follows:

Command	Range	Description
TEST	6	XCON test number
PATT	0--7	Signal pattern
TYPE	CR	Carrier transmission type
TYPG	N	Local Carrier Interface card—generator
SUPL	0–156	Superloop in multiple of 4
SLOT_CARR	xx	Carrier timeslots ranges: E1 Carrier 0 (5–31) E1 Carrier 1 (37–63) E1 Carrier 2 (69–95) T1 Carrier 0 (5–25) T1 Carrier 1 (37--47) T1 Carrier 2 (69–89)
TYPD	N	Local Carrier Interface card—detector
SUPL	0--156	Superloop in multiple of 4
LBTY	P	Loopback through Remote Carrier Interface card
LBTN	I1 s 99	Special Remote Carrier Interface loopback channel
TAG x	0--15	Tag number assigned by the system

5 Check the loopback test results. The results are automatically displayed if you specified XCON 0 test conditions; otherwise, you must specify XSTA or XSTP with the test TAG number to check the status. XSTA gets the status of the manual continuity test and XSTP stops the manual continuity test. If the results show BSDxxx messages, refer to the list and description of these messages in *X11 input/output guide (553-3001-311)*. The BSDxxx messages indicate the possible causes of the problem, which you should check to isolate the actual problem.

— If the loopback continuity test passes, the problem may be somewhere in the IPE cards.

— If the loopback continuity test fails, go to Procedure 4.

Remote Carrier Interface card fault isolation and correction

The Remote Carrier Interface card provides a communication interface between the Local Carrier Interface card and the IPE cards housed in the Carrier Remote IPE module or cabinet.

Problems with the Remote Carrier Interface card may be caused by hardware faults, incorrect configuration, a disabled Remote Carrier Interface card, or continuity problems between the card and IPE cards connected to the peripheral bus. To isolate and correct the Remote Carrier Interface card-related problems, follow procedures 4 and 5.

Procedure 4
Performing the Remote Carrier Interface card self-test

If the Remote Carrier Interface card is faulty, you should conduct the self-test to verify that it is actually faulty before you replace it. This test verifies the basic Remote Carrier Interface card functions and outputs a fail or pass message after the test is completed. During self-test the Remote Carrier Interface card displays HEX messages indicating the test performed. To identify the codes displayed, refer to Table 22 on page 221.

To start the self-test:

1 Log in on the maintenance terminal as described in "Using system maintenance programs" on page 191.

2 At the **>** prompt, type **LD 32** and press the Enter key to access the Network and PE Diagnostic Program.

3 Type **DSXP x** and press the Enter key to disable the Remote Carrier Interface card, where **x** is the number of the Remote Carrier Interface card you are disabling.

4 Type **XPCT x** and press the Enter key to start the self-test, where **x** is the Remote Carrier Interface card specified for self-test.

If the response is

TEST PASSED

the Remote Carrier Interface card passed the self-test and is functional but must be enabled to turn off the red LED and to start processing calls.

Type **ENXP x (v)** and press the Enter key to enable the card and the associated IPE cards, where **x** is the Remote Carrier Interface card number and (**v**) is the optional download software version **v**.

If the Remote Carrier Interface card passed the self-test, but the problem persists, the carrier link or other cards that interface with the Remote Carrier Interface card may be faulty. To verify the integrity of the peripheral bus and the Remote Carrier Interface card, go to Procedure 5.

If the response is

TEST FAILED REASON: **xxxx**

the Remote Carrier Interface card failed the self-test and is faulty, where **xxxx** specifies the cause of the fault. An NPRxxx message may be displayed as a result of a command-activated self-test if the Remote Carrier Interface card is missing, not configured, etc.

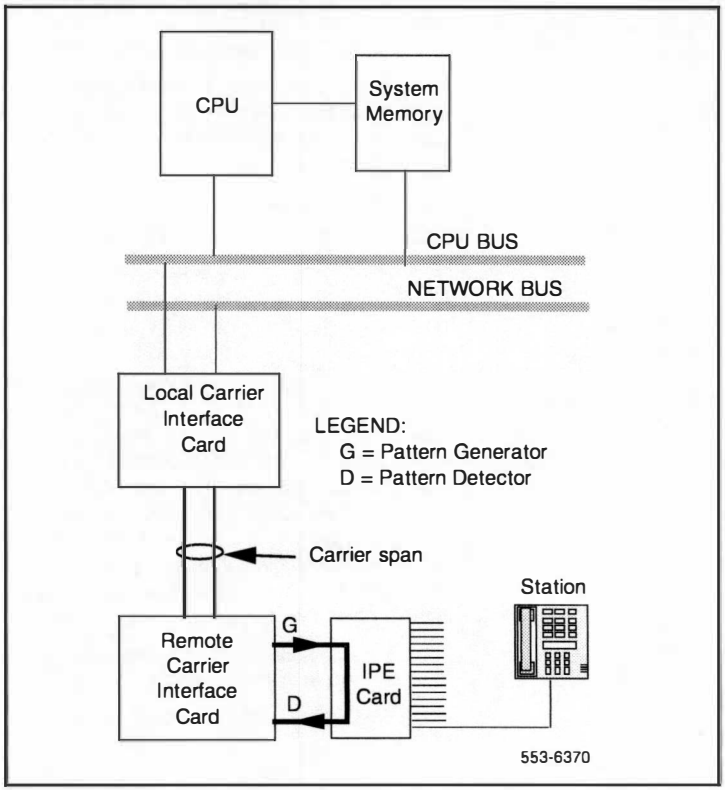
5 Exit LD 32 by typing ******** at the prompt.

Procedure 5
Performing the Remote Carrier Interface card loopback test

The loopback uses the Remote Carrier Interface card as a pattern generator and detector. The signal is transmitted by the Remote Carrier Interface card back to the Remote Carrier Interface card over a timeslot of a specified carrier.

Figure 26 illustrates the loopback path and shows the Remote Carrier Interface card as a test pattern generator and detector.

Figure 26
Loopback path for XCON test 7



To start the loopback test:

1 Log in on the maintenance terminal as described in "Using system maintenance programs" on page 191.

2 At the **>** prompt, type **LD 45** and press the Enter key.

3 Select the test condition. Enter XCON 0 and press the Enter key if you wish to perform only one loopback test.

— Enter one test period shown in XCON H 1-255, M 1-255, Sþ1-255 and press the Enter key to select continuous loopback testing for a selected time span, where Hþ1-255 is 1 to 255 hours, M 1-255 is 1 to 255 minutes, and S 1-255 is 1 to 255 seconds.

Example: XCON M 5 specifies the duration of the test to be 5þminutes.

4 At the TEST prompt, type **7** and press the Enter key to test Remote Carrier Interface to Remote Carrier Interface through a special loopback channel. Continue responding to the prompts to configure the loopback test as follows:

Command	Range	Description
TEST	7	XCON test number
PATT	0–7	Signal pattern
TYPG	P	Remote Carrier Interface card—generator
TN	l s 99 0	Special Remote Carrier Interface loopback channel
TAG x	0–15	Tag number assigned by the system

5 Check the loopback test results. The results are automatically displayed if you specified XCON 0 test conditions; otherwise, you must specify XSTA or XSTP with the test TAG number to check the status. XSTA gets the status of the manual continuity test and XSTP stops the manual continuity test. If the results show BSDxxx messages, refer to the list and description of these messages in *X11 input/output guide (553-3001-311)*. The BSDxxx messages indicate the possible causes of the problem, which you should check to isolate the actual problem.

— If the loopback continuity test passes, the problem may be somewhere in the IPE cards.

— If the loopback continuity test fails, replace the card.

Fault isolation and correction using MMI maintenance commands

You can perform some testing and troubleshooting of the Carrier Remote IPE from a local or a remote MMI terminal or TTY by typing MMI commands on the terminal without loading system diagnostic programs (overlays).

These commands provide current equipment status, invoke card testing, check equipment performance, and print messages from log files.

Procedure 6
Checking Carrier Remote IPE status using MMI commands

This procedure uses MMI commands to maintain Carrier Remote IPE cards and carrier status.

In the MMI mode the terminal issues direct commands to the system to display operational conditions, to set up carrier parameters, and to test individual carrier links.

To obtain the Local and Remote Carrier Interface card status:

1 Log in on the MMI maintenance terminal:

CRI:: >L	Login command
Enter Password > **M1LINK**	Type in the password.

2 Type **D S** to display near-end carrier status. Type **D S D** to display far-end carrier status.

The response is displayed on the screen and shows: the firmware version, present time and date, individual carrier fault threshold parameters, and the present status of each carrier link.

Example:

CRI::>D S
CRI Remote IPE S/N Software Version x.xx mm/dd/yy hh:mm
Remote Site
In Alarm State: NO (carriers are not in the alarm state)

All Link Maps Normal

Link 0 Alarm Level 0
Link 1 Alarm Level 0
Link 2 Alarm Level 0

If carrier links mismatch exists, the status will display unequal alarm levels across a mismatched link. To verify that carrier links are connected correctly at both ends perform the tests in "Verifying carrier link connections at the remote site" on page 159 in the Installation section.

3 Display the alarm log by executing the **D A** and the **D A D** commands to see the list of the most recent 100 alarms with the date and time they occurred.

Procedure 7
Checking the carrier performance status

The Remote Carrier Interface card can display carrier performance information for the current hour and for the last 24 hours. The data and total errors are shown separately in the report for both the local and the remote site. The report displays the bit error rate, loss of frame count, loss of signal, alarm indication count, and frame slip count. To obtain the information for the current hour, execute command **D P** (Display performance) for near-end or **D P D** (Display performance distant) for the far-end carrier performance status using the MMI terminal.

To obtain the carrier link performance status:

1 Log in on the maintenance terminal as described in "Using system maintenance programs" on page 191.

2 At the > prompt, type **D P** and press the Enter key.

The report displays the following carrier error counts monitored for 45 minutes for carrier 1

CRI::> D P

Which Carrier (0, 1, or 2): 1

IPE Interface Performance Log

For Carrier Number 1

8/15/95 9:45

Data for the first 45 Minutes

Errored Seconds	Bursty Seconds	Severely Eroded Seconds	Unavailable Seconds	Loss Frame Seconds	Frame Slip Seconds	Error Counter
0	0	0	0	0	0	1

Note: These performance measurements indicate the service quality of the carrier link you selected (carrier 1 in this example). Ideally all errored second categories should be 0. If a number other than 0 appears in one or more columns, it indicates momentary or continuous problem on the link. If the numbers are small and the carrier is not in alarm state, the errors may have been temporary and the link may continue to operate within the specified thresholds.
You may clear the cumulative error counter by executing the **C E** and **C E D** commands. This error clearing does not affect the errored second counters.

3 To display a similar report for the 24 hour period listed in 1 hour increments execute the **D H** (Display history) for the near-end or **D H D** (Display history distant) for the far-end.

CRI::> D H

Which Carrier (0, 1, or 2): 1

IPE Interface History Performance Log

For Carrier Number 1

8/15/95 9:45

Hour Ending	Errored Seconds	Bursty Seconds	Unavailable Seconds	Loss Frame Seconds	Frame Slip Seconds	Error Counter
9:00	0	0	0	0	0	0
8:00	1	0	0	0	0	1
7:00	0	0	0	0	0	0
|	|	|	|	|	|	|
0:00	0	0	0	0	0	0
23:00	1	1	0	0	0	1
22:00	0	0	0	0	0	0
21:00	0	0	0	0	0	0
|	|	|	|	|	|	|
11:00	1	1	1	1	1	1
10:00	0	0	0	0	0	0

Note: This report list the 24-hour performance history for this carrier. Ideally all the parameters should show 0 for optimum performance. However, if the carrier is not in alarm state, it may continue to perform within the specified threshold limits.

Procedure 8
Disabling a carrier when idle to check the carrier sparing function or to perform off-line carrier tests

1 Execute the **S C** command to disable the primary carrier of your choice. This command allows the calls in progress to complete before the carrier can be disabled. The MMI terminal displays the following screen to allow you to change carrier status:

To disable carrier 1 (set Equipped carrier 1 parameter to N)**:**

CRI::> S C	To set carrier parameters
Equipped carrier 0 (Yes or No) Y	Enable carrier 0. Enter Y to enable or N to disable.
Equipped carrier 1 (Yes or No) N	Disable carrier 1.
Equipped carrier 2 (Yes or No) Y	To enable carrier 2
Enable #2 for Spare (Yes or No) Y	Defines carrier 2 as spare
Enable self clearing Alarms (Yes or No) N	To enable/disable alarm clearing

2 Track the number of calls still active on carrier 1 by executing the STAT command:

LD 32

NPR000

STAT sl

CARR	CALS	TTSA	NND	SPARED
0	0	19/21	NO	NOT spared
1	1	18/21	YES	NOT spared
2	0	21/21	NO	NOT spared

Note: In the CALS column for carrier 1, it shows that carrier alarm status has alarm level 1 and no new data is allowed.

Procedure 9
Testing the carriers

1 After you check the carrier status report and performance log and you find that one or more carriers are faulty, proceed to isolate the cause by testing the carriers using the **T** (test) command.

There are two types of tests that can be performed using the **T** command. These are on-line tests and off-line tests.

The **on-line carrier test (Test #1)** is end-to-end carrier test performed without affecting the system performance and determines that a failure exists but cannot pinpoint the faulty component. Perform Test #1 on a known good carrier to switch signaling communication over this carrier. Don't test a carrier in alarm condition using Test #1, it may disrupt traffic for the duration of the test. A better approach is to disable the carrier you wish to test and perform one of the other tests to determine where the problem lies.

Note: Disabling a carrier will prevent any new calls being placed over that carrier; however, it will not effect calls in progress over the disabled carrier. Performing Test #2 or #3 on a carrier will interrupt any calls in progress over that carrier for the duration of the test.

The **off-line carrier tests (Tests #2, #3, #4, and #5)** isolate the failure to a field-replaceable unit. These tests are usually performed on carriers that are not carrying traffic. The user must specify the carrier to be tested and the duration of the test.

Test #2 tests the near-end card by looping back the carrier link side and verifies if the card is good.

Test #3 tests the far-end card by looping back the carrier link side on the distant card and verifies if that card is good.

Test #4 tests the carrier link side by looping back at the near-end or far-end CSU to test the link from the telco demarcation point to the Meridian 1 or Carrier Remote IPE or from the far-end CSU to test the carrier link.

Test #5 provides a near-end loopback on the card to allow the distant testing of the near-end card across the carrier link.

Note: Test #2 and #3 may show occasionally false failure indication when a false bit error is detected by the test logic falsely indicating a test failure. If only one or two errors are shown out of 15 tests, try the test again. If the test passes on the second or third attempt, the carrier is probably performing correctly. To verify the performance, execute C A and C A D to clear errors. Then display performance by executing the D P and D P D commands. The carrier is operational if no additional errors are detected. The STOP command terminates a test prematurely; however, it does not terminate the remote loopback during carrier Test #3 and may interrupt the traffic for several seconds. If the STOP command causes a problem, execute Test #3 again with 0 duration to undo the far-end loopback or do not use the STOP command on Test #3.

Test 5 places the carrier in the loopback and test 4 works only if you first establish an external loopback at the network or at the far-end.

Split pairs in the twisted pair patch cable between the telco network interface and the Local and Remote Carrier Interface cards may cause repetitive loss of frame errors despite passing loopback tests on both ends of the cable.

2 Logon and type **T** and press the Enter key to display the selection of tests. Select the appropriate test and press the Enter key:

CRI:>L
Enter Password: M1LINK

CRI::>L
CRI::>T
Test 1: Online Test
Test 2: Near End Loopback Test
Test 3: Remote Loopback
Test 4: Network Loopback
Test 5: Loop only
(1, 2, 3, 4, 5, or S to cancel): 1
Which carrier (0, 1, or 2): 2
Carrier Currently ENABLED
Enter Duration of Test (1-98 minutes, 0= once, 99= forever): _
Test will not interfere with calls in progress
Hit Q to quit or any key to continue

Near End Testing

Carrier 2 Test 1 Completed. Total Test 1 Total Errors 0.

If an off-line test is selected, the user is prompted with:

This test will interfere with calls currently in progress, continue ?: (Y or N): _

3 Check the results of the test and correct the identified fault. Replace the faulty card or fix the problem in the carrier link if so indicated in the test report.

Replacing Carrier Remote IPE cards

If after completing troubleshooting you determine that one or more Carrier Remote IPE cards are defective, you will have to remove them and replace them with spares. When you insert a spare Local Carrier Interface card or a Remote Carrier Interface card into the module or Carrier Remote IPE cabinet, observe the card LED (the uppermost LED on the faceplate) to determine if the card passed the self-test. Package and ship the defective cards to an authorized repair center.

Unpacking replacement cards

Unpack and visually inspect replacement cards as follows:

1 Inspect the shipping container for damage. Notify your distributor if you find that the container is damaged.

2 Remove the unit carefully from the container. Do not puncture or tear the container; use a utility knife to open it. Save the container and the packing material for shipment of the defective card.

3 Visually inspect the replacement card for obvious faults or damage. Report the damage to your sales representative.

4 Keep cards in their antistatic bags until you are ready to install them. Do not stack them on top of each other.

5 Install cards. When handling the cards, hold them by their nonconductor edges to prevent damage due to static discharge.

Removing and replacing a card

A Carrier Remote IPE card can be removed from and inserted into a Meridian 1 module or the Remote IPE module or Carrier Remote IPE cabinet without turning off the power to the module or cabinet. This feature allows Meridianþ1 to continue normal operation when you replace a Local Carrier Interface card in the system or a Remote Carrier Interface card in the Remote IPE module or cabinet.

Removing and replacing a Local Carrier Interface card

1 Disable the Local Carrier Interface card by logging into the system terminal, loading the Network and Peripheral Equipment Diagnostic Program LD 32, and executing **DISL sl**, where **sl** is the actual loop number of the Local Carrier Interface card.

2 Set the ENB/DIS switch to DIS.

3 Disconnect the cable from the Local Carrier Interface card faceplate.

4 Unlatch the card locking devices by squeezing the tabs and pulling the locking devices away from the card.

5 Pull the card out of the network module and place it into an antistatic bag away from the work area.

6 Set the replacement card ENB/DIS switch to DIS.

7 Hold the replacement card by the card locking devices and insert it partially into the card guides in the module.

8 Pull the upper and lower locking devices away from the faceplate on the card and insert the card firmly into the backplane connector. Press the card locking devices firmly against the faceplate to latch the card inside the module.

9 Upon insertion, the Local Carrier Interface card automatically starts the self-test.

10 Observe the red LED on the front panel during self-test. If it flashes three times and stays on, it has passed the test. Go to step 11. If it does not flash three times and then stays on, it has failed the test. Pull the card partially out of the module and reinsert it firmly into the module. If the problem persists, troubleshoot or replace the Local Carrier Interface card.

11 Connect the cable to the Local Carrier Interface card faceplate connector.

12 Set the ENB/DIS switch to ENL. If the uppermost red LED on the Local Carrier Interface card faceplate turns off, the card is functioning correctly and is enabled. The outcome of the self-test will be indicated on the system terminal or TTY (or the MMI terminal connected to the SDI/System Monitor connector on the Local Carrier Interface card faceplate). If the LED stays on, go to "Isolating and correcting faults" on page 194 in this chapter.

13 Tag the defective cards with a description of the problem and prepare them for shipment to your equipment supplier's repair depot.

Removing and replacing a Remote Carrier Interface card

1 Log in on the maintenance terminal as described in "Using system maintenance programs" on page 191.

2 At the > prompt, type **LD 32** and press the Enter key to access the program.

3 Type **DSXP x**, where **x** is the Remote Carrier Interface card number, and press the Enter key to disable the card. The Remote Carrier Interface card is now disabled and you can remove it.

4 Unlatch the card locking devices by squeezing the tabs and pulling them away from the card.

5 Pull the card out of the IPE module or cabinet and place it into an antistatic bag away from the work area.

6 Hold the replacement card by the card locking devices and insert it partially into the card guides in the module.

7 Pull the upper and lower locking devices away from the faceplate on the card and insert the card firmly into the backplane connector. Press the card locking devices firmly against the faceplate to latch the card inside the module. The Remote Carrier Interface card automatically starts the self-test.

8 Observe the red LED on the front panel during the self-test. If it flashes three times and stays on, it has passed the test. Go to step 9. If it does not flash three times and then stays on, it has failed the test. Pull the card partially out of the module and reinsert it firmly into the module. If the problem persists, troubleshoot or replace the Remote Carrier Interface card.

9 At the . prompt in the LD 32 program, type **ENXP x (v)**, where **x** is the Remote Carrier Interface card number and **v** is the loadware version that can be optionally downloaded after the enabling process, and press the Enter key to enable the card. If the uppermost red LED on the Remote Carrier Interface card faceplate turns off, the card is functioning correctly and is enabled. The outcome of the self-test will be indicated by LD 32 on the MMI terminal connected to the Remote Carrier Interface card. If the LED stays on, go to "Isolating and correcting faults" on page 194 in this chapter or replace the card.

10 Tag the defective cards with a description of the problem and prepare them for shipment to your equipment supplier's repair depot.

Reinstalling covers

When you determine that the Carrier Remote IPE is operating correctly, do the following:

1 Reinstall covers on the system module.

2 Reinstall the cover on the Remote IPE floor-standing module or the wall-mounted (or pedestal-mounted) Carrier Remote IPE cabinet.

3 Terminate your session with the system by logging out on your maintenance terminal by typing **LOGO** at the . prompt and pressing the Enter key. If using the MMI terminal, log out to complete the test and troubleshooting session.

Packing and shipping defective cards

To ship a defective card to a Nortel Networks repair center, you should:

1 Tag the defective card with the description of the problem.

2 Package the defective card for shipment using the packing material from the replacement card. Place the card in an antistatic bag, into the box, and securely close the box with tape.

3 Obtain shipping and cost information from Nortel Networks and mail the package to an authorized repair center.

Appendix A: System messages

Table 22 in this appendix lists CRI-related system messages displayed or printed on the system and MMI terminal or TTY.

> ***Note:*** CRInnnn messages are suppressed for a given superloop if alarms are disabled by the MMI command **A D** (Alarm Disable). CRInnnn messages are suppressed for a given carrier link if it is UNEQUIPPED by the MMI command **S C** (Set Configuration).

Table 23 lists HEX codes displayed by the alphanumeric display on the Remote Carrier Interface card faceplate.

Table 22
System error messages related to the CRI (Part 1 of 5)

Error Code	Message description
BSD805/806	Superloop timeslot not available. Check the timeslot allocation for each T1/E1 carrier.
NPR0019	LCI did not respond to the request of disable/enable the RTE superloop. Ensure that the LCI is installed and that the ENL/DIS switch is in ENL position.
NWS0019	LCI did not respond to the request of disable/enable the superloop. Ensure that the LCI is installed and that the ENL/DIS switch is in ENL position.
PWRxxxx	Carrier Remote IPE cabinet system monitor emulation.
SCH6575	REM_IPE package is not equipped.
SCH6576	Missing LCI software from disk.
SCH6577	Cannot change SUPT in the defined superloop. Superloop is not disabled.

Table 22
System error messages related to the CRI (Part 2 of 5)

Error Code	Message description
CRIabcd	Where a=1 for local and 2 for remote, 3 for external, b= carrier 0, 1, or 2, c= alarm lever 1, 2, or 3, and d= 0 for bit error, 1 for frame slip, 2 for loss of signal, 3 for blue alarm, 4 for out-of-frame, 5 for within threshold, and 6 for MMI enabled i.e. carrier equipped via MMI configuration commands. This is shown in subsequent system error messages.
Bit error rate error code description	
CRI1010	Local Carrier 0 Alarm Level 1. Bit error rate exceeded.
CRI1020	Local Carrier 0 Alarm Level 2. Bit error rate exceeded.
CRI1030	Local Carrier 0 Alarm Level 3. Bit error rate exceeded.
CRI1110	Local Carrier 1 Alarm Level 1. Bit error rate exceeded.
CRI1120	Local Carrier 1 Alarm Level 2. Bit error rate exceeded.
CRI1130	Local Carrier 1 Alarm Level 3. Bit error rate exceeded.
CRI1210	Local Carrier 2 Alarm Level 1. Bit error rate exceeded.
CRI1220	Local Carrier 2 Alarm Level 2. Bit error rate exceeded.
CRI1230	Local Carrier 2 Alarm Level 3. Bit error rate exceeded.
CRI2010	Remote Carrier 0 Alarm Level 1. Bit error rate exceeded.
CRI2020	Remote Carrier 0 Alarm Level 2. Bit error rate exceeded.
CRI2030	Remote Carrier 0 Alarm Level 3. Bit error rate exceeded.
CRI2110	Remote Carrier 1 Alarm Level 1. Bit error rate exceeded.
CRI2120	Remote Carrier 1 Alarm Level 2. Bit error rate exceeded.
CRI2130	Remote Carrier 1 Alarm Level 3. Bit error rate exceeded.
CRI2210	Remote Carrier 2 Alarm Level 1. Bit error rate exceeded.
CRI2220	Remote Carrier 2 Alarm Level 2. Bit error rate exceeded.
CRI2230	Remote Carrier 2 Alarm Level 3. Bit error rate exceeded.

Table 22
System error messages related to the CRI (Part 3 of 5)

Error Code	Message description
Frame slip error code description	
CRI1031	Local Carrier 0 Alarm Level 3. Frame slip threshold exceeded.
CRI1131	Local Carrier 1 Alarm Level 3. Frame slip threshold exceeded.
CRI1231	Local Carrier 2 Alarm Level 3. Frame slip threshold exceeded.
CRI2031	Remote Carrier 0 Alarm Level 3. Frame slip threshold exceeded.
CRI2131	Remote Carrier 1 Alarm Level 3. Frame slip threshold exceeded.
CRI2231	Remote Carrier 2 Alarm Level 3. Frame slip threshold exceeded.
Loss of signal error code description	
CRI1032	Local Carrier 0 Alarm Level 3. Loss of signal.
CRI1132	Local Carrier 1 Alarm Level 3. Loss of signal.
CRI1232	Local Carrier 2 Alarm Level 3. Loss of signal.
CRI2032	Remote Carrier 0 Alarm Level 3. Loss of signal.
CRI2132	Remote Carrier 1 Alarm Level 3. Loss of signal.
CRI2232	Remote Carrier 2 Alarm Level 3. Loss of signal.
Blue alarm error code description	
CRI1033	Local Carrier 0 Alarm Level 3. Blue alarm.
CRI1133	Local Carrier 1 Alarm Level 3. Blue alarm.
CRI1233	Local Carrier 2 Alarm Level 3. Blue alarm.
CRI2033	Remote Carrier 0 Alarm Level 3. Blue alarm.
CRI2133	Remote Carrier 1 Alarm Level 3. Blue alarm.
CRI2233	Remote Carrier 2 Alarm Level 3. Blue alarm.

Table 22
System error messages related to the CRI (Part 4 of 5)

Error Code	Message description
Out of frame error code description	
CRI1034	Local Carrier 0 Alarm Level 3. Out of frame.
CRI1134	Local Carrier 1 Alarm Level 3. Out of frame.
CRI1234	Local Carrier 2 Alarm Level 3. Out of frame.
CRI2034	Remote Carrier 0 Alarm Level 3. Out of frame.
CRI2134	Remote Carrier 1 Alarm Level 3. Out of frame.
CRI2234	Remote Carrier 2 Alarm Level 3. Out of frame.
Operation within threshold message description	
CRI1005	Local Carrier 0 Alarm Level 0. Within threshold.
CRI1105	Local Carrier 1 Alarm Level 0. Within threshold.
CRI1205	Local Carrier 2 Alarm Level 0. Within threshold.
CRI2005	Remote Carrier 0 Alarm Level 0. Within threshold.
CRI2105	Remote Carrier 1 Alarm Level 0. Within threshold.
CRI2205	Remote Carrier 2 Alarm Level 0. Within threshold.
Disabled/unequipped error code description	
CRI1036	Carrier 0 MMI disabled/unequipped.
CRI1136	Carrier 1 MMI disabled/unequipped.
CRI1236	Carrier 2 MMI disabled/unequipped.
CRI1006	Carrier 0 MMI enabled/equipped.
CRI1106	Carrier 1 MMI enabled/equipped.
CRI1206	Carrier 2 MMI enabled/equipped.

Table 22
System error messages related to the CRI (Part 5 of 5)

Error Code	Message description
External alarm error code description	
CRI3311	RCI external alarm closure. Alarm contact 1 closed.
CRI3312	RCI external alarm closure. Alarm contact 2 closed.
CRI3313	RCI external alarm closure. Alarm contact 3 closed.
CRI3301	RCI external alarm closure. Alarm contact 1 open.
CRI3302	RCI external alarm closure. Alarm contact 2 open.
CRI3303	RCI external alarm closure. Alarm contact 3 open.

Table 23
Remote Carrier Interface HEX error codes for self-test (Part 1 of 2)

HEX code	Test description
00	Peripheral Controller ID while waiting for PSDL.
01	RAM test
02	A31 #1 external buffer
03	A31 #1 internal context memory (phase A)
04	A31 #1 internal context memory (phase B)
05	A31 #1 internal TXVM memory
06	A31 #1 configuration memory
07	A31 #1 external FIFO
08	A31 #2 external buffer
09	A31 #2 internal context memory (phase A)
0A	A31 #2 internal context memory (phase B)
0B	A31 #2 internal TXVM memory
0C	A31 #2 configuration memory
0D	A31 #2 external FIFO

Table 23
Remote Carrier Interface HEX error codes for self-test (Part 2 of 2)

HEX code	Test description
0E	A31 #1 Peripheral side W72 loopback test
0F	A31 #2 Peripheral side W72 loopback test
10	R72 N-P switching control memory
11	R72 320x8 NIVD buffer
12	R72 N-P Quiet code register
13	R72 P-N switching control memory
14	R72 640-8 XIVD buffer
15	R72 640-8 XIVD loopback buffer test
16	R72 P-N Quiet code register
17	R71 register test
18	R71 continuity test, peripheral side
19	R71 continuity test, network side
1A	R71 packet transmission test
1B	DUART port A
1C	DUART port B
1D	RCIM shelf test
1E	End of test
1F	R72 #2 N-P quiet-code register test
EE	Bus error, exception errors, etc.

Note: After PSDL, the display on the Carrier Remote Interface card alternates between Peripheral Controller ID and the carrier 0 indicating that the clock reference is being received from carrier 0.

Appendix B: Regulatory approvals

This appendix provides the general information that is supplied to the user as required by the FCC.

The general information that should be provided:

— The FCC registration number and a list of all ports that connect to the network

— Explanation and use of the ringer equivalence number

— Rights of the telephone company

— What happens in case of telephone company equipment modification and in case of equipment trouble

— Location of a repair center in the U. S. A.

— List of repairs a user or customer may be allowed to make

— Rules about the coin service and state tariffs

Regulatory notices

Notice for United States Installations

Meridian 1 Carrier Remote IPE equipment complies with Part 68 of the United States Federal Communication Commission (FCC) rules. On the rear of the pedestal unit of the switching equipment cabinet is a label that contains, among other information, the FCC registration numbers and ringer equivalence number (REN) for this equipment. If required, this information must be provided to the telephone company.

Meridian 1 regulatory labels include:

— FCC registration: AB6982-14234-MF-E

— FCC registration: AB6982-62937-PF-E

— FCC registration: AB6USA-18923-KF-E

— FCC registration: AB6CAN-18924-KF-E

— FCC registration: AB6CAN-61116-PF-E

— FCC registration: AB6CAN-61117-MF-E

— Service Code: 9.0F, Ringer equivalent: 1.1B (1.0A)

If your Meridian 1 Carrier Remote IPE equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice is not practical, the telephone company will notify the customer as soon as possible. You will also be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the proper operation of your equipment. If this happens, the telephone company will provide advance notice in order for you to make the necessary modifications to maintain uninterrupted service.

If you experience trouble with Meridian 1 Carrier Remote IPE equipment, please contact your authorized distributor or service center in the U.S. A. for repair/warranty information. If you do not know how to contact your distributor, please call Nortel Networks Inc., 2221 Lakeside Drive, Richardson, TX 75082 at 1-800-328-8800. If the trouble is causing harm to the telephone network, the telephone company may request you to remove the equipment from the network until the problem is resolved. There is no user repair involved with this equipment.

The equipment cannot be used on public coin service provided by the telephone company. Connection to Party Line Service is subject to state tariffs. Contact the state public utility commission, public service commission, or corporation commission for information.

Allowing Meridian 1 Carrier Remote IPE equipment to operate without proper answer supervision signals is a violation of FCC Rules, Part 68. Therefore:

— This equipment returns proper answer supervision signals to the Public Switched Telephone Network (PSTN) when:

- answered by the called station
- answered by the attendant
- routed to a recorded announcement device that can be administered by the CPE user
- routed to a dial prompt

— This equipment returns answer supervision on all DID calls forwarded back to the PSTN. Permissible exceptions are:

- a call is unanswered
- a busy tone is received
- a reorder tone is received

This equipment is capable of providing users access to interstate providers of operator services through the use of equal access codes. Failure to provide equal access capabilities is a violation of the Telephone Operator Consumer Services Improvement Act of 1990 and Part 68 of the FCC Rules.

Network connection information

Listed in Table 24 are the Carrier Remote IPE network interfaces (Manufacturers Port ID) one located at the Meridian 1 system site and the other at the remote site.

Table 24
Carrier Remote IPE network interfaces

Reg. Status	Digital Interfaces (FIC)	Manufacture Port ID	Service Order Code	Network Jacks
M	04DU9-BN	NT7R51 NT7R52	6.0P	N/A
M	04DU9-DN	NT7R51 NT7R52	6.0P	N/A
M	04DU9-1KN	NT7R51 NT7R52	6.0P	N/A
M	04DU9-1SN	NT7R51 NT7R52	6.0P	N/A
Note: Digital Interfaces represent the Facility Interface Codes (FIC)				

Notice for Canadian Installations

Meridian 1 regulatory labels include:
Department of Communication (CS03): 332 404 A

The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. The Department does not guarantee that the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. the equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the use to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

WARNING

Users should not attempt to make electrical ground connections, but should contact the appropriate electrical inspection authority or an electrician, as appropriate.

Appendix C: Connection diagrams and external connectors pin assignment

This appendix provides connection diagrams and pin assignment information for all connectors interfacing with external equipment.

Figure 27
Single LCI connection diagram (local site connections)

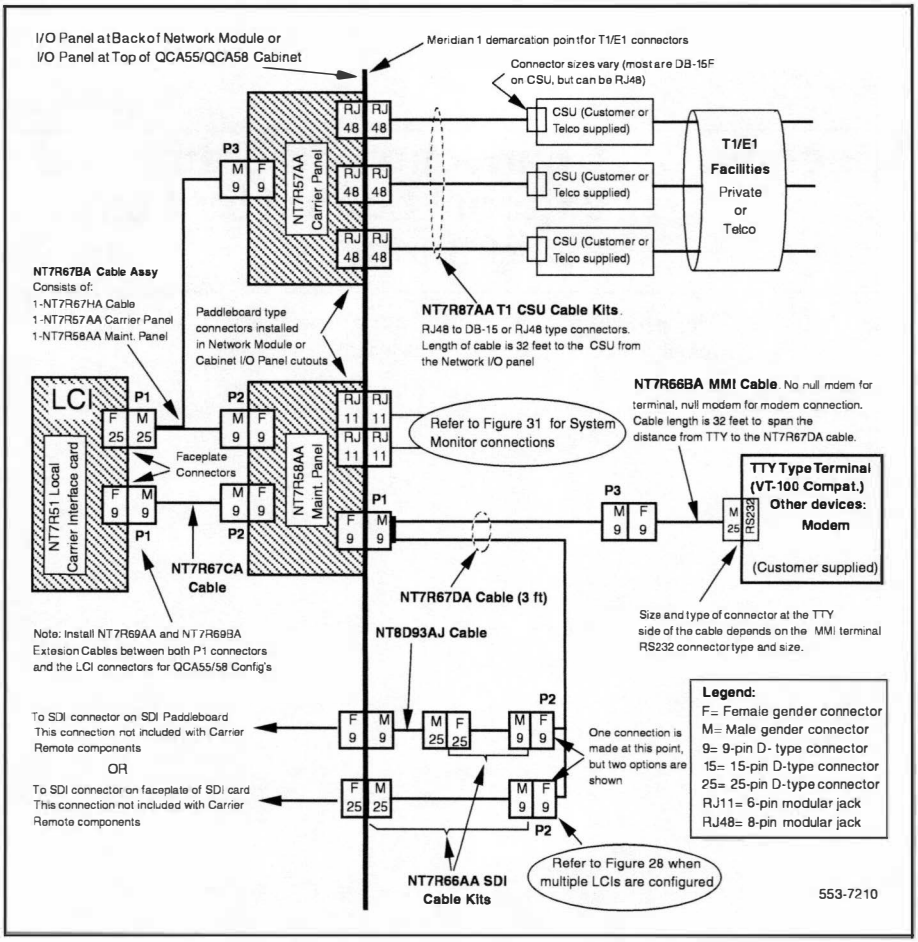


Figure 28
Multiple LCIs connection diagram (local site daisy-chain connection)

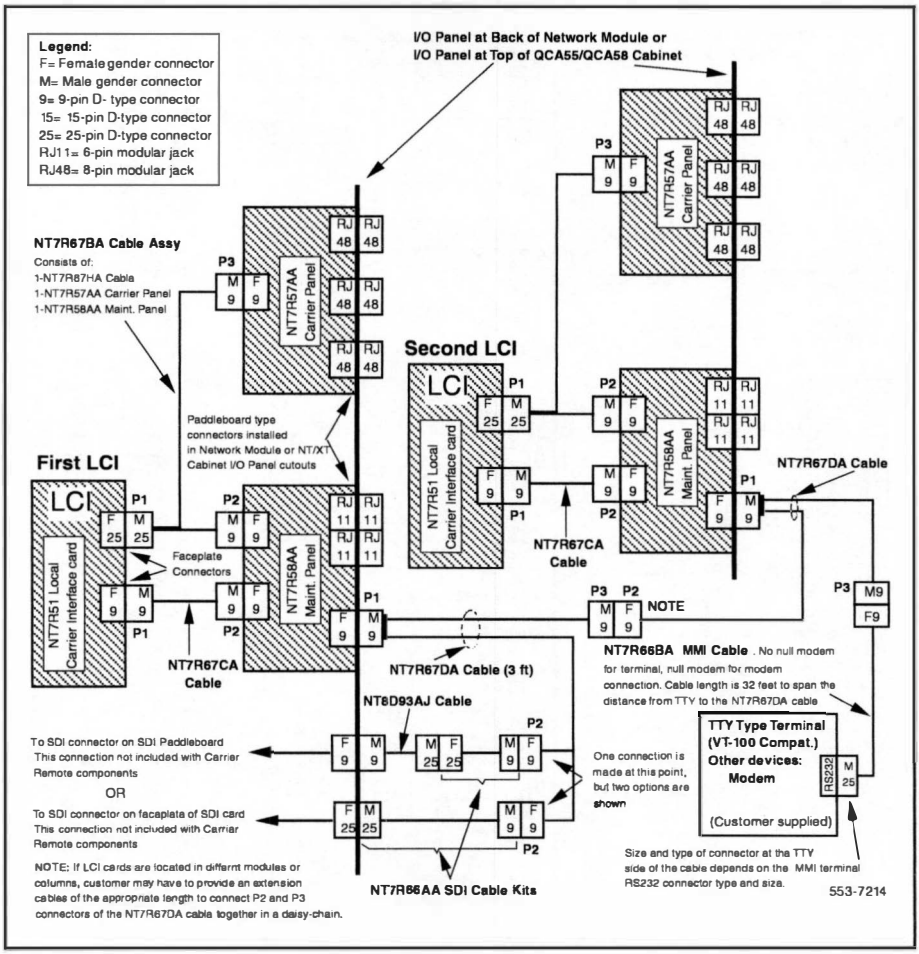


Figure 29
Remote Carrier IPE module connection diagram (single RCI configuration)

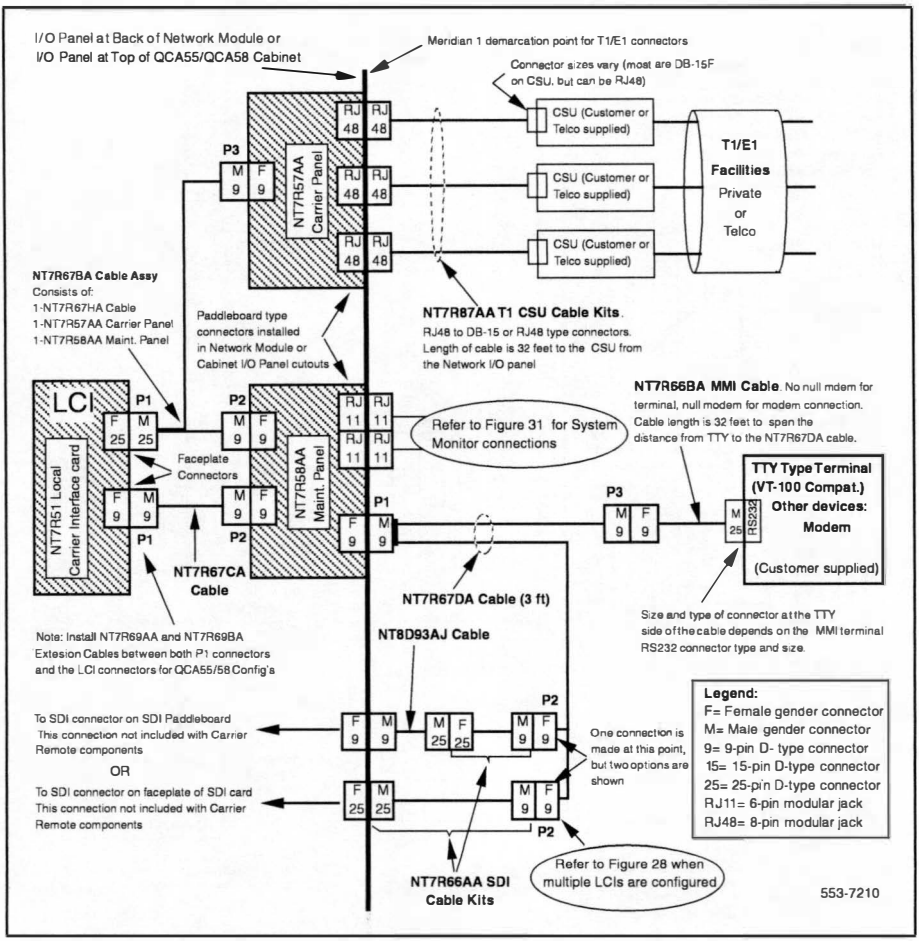


Figure 30
Remote Carrier IPE cabinet connection diagram (single RCI configuration)

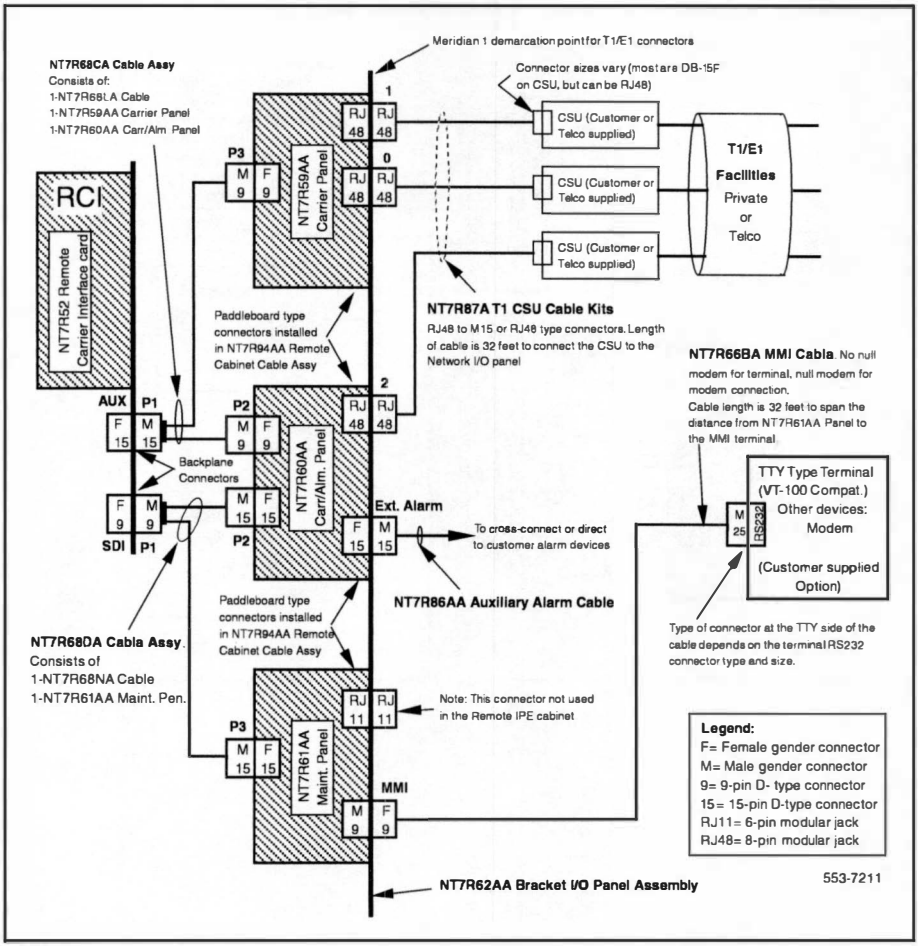
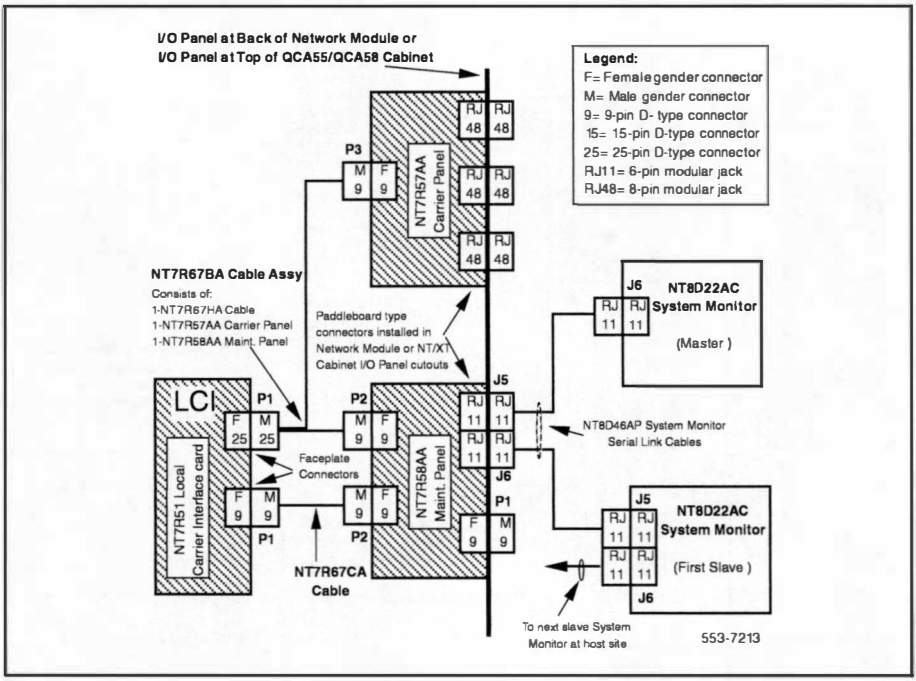


Figure 31
Local site system monitor connection diagram (single and multiple LCI configuration)



It also provides the pin assignment for the NT7R57DA External Maintenance Cable assembly, which connects the Maintenance port on the I/O panel to the SDI port and the MMI terminal.

Table 25
8-pin modular jack pin assignment for all carrier connections

T1/E1 Carrier Link 8-Pin Modular Jack Pinouts		
8-Pin Modular Jack	**Signal Name**	**Signal Description**
1	RTIPx	T1/E1 Carrier Receive Tip (from net)
2	RRINGx	T1/E1 Carrier Receive Ring (from net)
3	N/C	No connection
4	TRINGx	T1/E1 Carrier Transmit Ring (to net)
5	TTIPx	T1/E1 Carrier Transmit Tip (to net)
6	N/C	No connection
7	N/C	No connection
8	N/C	No connection

Note: The cable that connects to this connector is provided in the NT7T87AA T1 CSU Cable Kit. The cable is a straight through cables between the Carrier Remote IPE 8-pin modular jack and the Telco demarcation point. If the carrier links are just hardwired without using Telco network, pins 1 and 2 must be turned over (swapped) with pins 5 and 4 respectively at one end of the cable.

Table 26
NT7R58AA Maintenance Panel 6-pin modular jack system monitor pin assignment for J5 and J6 connectors

System Monitor 6-Pin Modular Jack Pinouts		
8-Pin Modular Jack	**Signal Name**	**Signal Description**
J5-1	N/C	No connection
J5-2	XSTXB	Transmit (NEGATIVE)
J5-3	XSTXA	Transmit (POSITIVE)
J5-4	XSRXB	Receive (NEGATIVE)
J5-5	XSRXA	Receive (POSITIVE)
J5-6	N/C	No connection
J6-1	N/C	No connection
J6-2	XMTXB	Transmit (NEGATIVE)
J6-3	XMTXA	Transmit (POSITIVE)
J6-4	XMRXB	Receive (NEGATIVE)
J6-5	XMRXA	Receive (POSITIVE)
J6-6	N/C	No connection

Note: J5 modular jack provides signals towards the Master system monitor and J6 modular jack provides signals away from the Master system monitor.

Table 27
NT7R58AA Local Maintenance Panel maintenance DCE port DB-9F and NT7R67DA External Maintenance Cable assembly connector pin assignment for P1 DB-9M, P2 DB-9M, and P3 DB-9F connectors

DB-9 Local Maintenance Port and NT7R67DA Cable Connector Pinouts				
DB-9 Pins	**NT7R67DA Cable Connectors Pins**		**Signal Name**	**Signal Description**
1	P1-1	P3-2	MNTX	MMI Transmit
2	P1-2	P3-3	MNRX	MMI Receive
3	P1-3	P2-3	SDITX	SDI Transmit
4	P1-4	P2-2	SDIRX	SDI Receive
5	P1-5	P2/P3 Pin 5	GND	Signal Ground (RS-232)
6	P1-6	P2/P3 Pin 7	REQA	Request from MMI Port
7	P1-7	P2/P3 Pin 9	REQB	Request from SDI Port
8	N/C	N/C	N/C	No connection
9	N/C	N/C	N/C	No connection
—	—	P2-4 to P2-6	DTR/DSR	Pins connected with 30 AWG wire

Table 28
NT7R61 Remote Maintenance Panel maintenance port DB-9 male connector pin assignment

DB-9 Remote Maintenance Connector Pinouts		
DB-9 Connector Pins	**Signal Name**	**Signal Description**
1	N/C	No connection
2	SDITX	SDI Transmit
3	SDIRX	SDI Receive
4	N/C	No connection
5	GND	Signal Ground (RS-232)
6	N/C	No connection
7	N/C	No connection
8	N/C	No connection
9	N/C	No connection

Table 29
NT7R60AA Carrier/Alarm Panel DB-15 HD alarm connector pin assignment for Carrier Remote IPE module

High Density DB-15 Alarm Connector Pinouts			
DB-15 Alarm Connector Pins	**Signal Name**	**Signal Description**	**Wire Color Code**
P1-1	N/C	No connection	N/C
P1-2	N/C	No connection	N/C
P1-3	N/C	No connection	N/C
P1-4	N/C	No connection	N/C
P1-5	N/C	No connection	N/C
P1-6	GND	Ground Return	Green
P1-7	ALM2	Customer External Alarm Input 2	Brown
P1-8	N/C	No connection	N/C
P1-9	N/C	No connection	N/C
P1-10	GND	Ground Return	See Note
P1-11	ALM1	Customer External Alarm Input 1	Blue
P1-12	ALM3	Customer External Alarm Input 3	White/Blue
P1-13	N/C	No connection	N/C
P1-14	N/C	No connection	N/C
P1-15	N/C	No connection	N/C

Note: This connection is jumpered to pin 6 inside the P1 DB-15 connector hood. No external voltage should be placed across the alarm inputs.

Table 30
NT7R60AA Carrier/Alarm Panel DB-15 HD alarm connector pin assignment for Carrier Remote IPE cabinet

High Density DB-15 Alarm Connector Pinouts			
DB-15 Alarm Connector Pins	**Signal Name**	**Signal Description**	**Wire Color Code**
P1-1	N/C	No connection	N/C
P1-2	N/C	No connection	N/C
P1-3	N/C	No connection	N/C
P1-4	N/C	No connection	N/C
P1-5	N/C	No connection	N/C
P1-6	GND	Ground Return	Green
P1-7	ALM2	Customer External Alarm Input 2 (5 V)	Brown
P1-8	–48 V	–48 V for PFTU	White/Brown
P1-9	PFTS	Power Fail Transfer Signal	White/Green
P1-10	GND	Ground Return	See Note 1
P1-11	ALM1	Customer External Alarm Input 1 (5 V)	Blue
P1-12	ALM3	Customer External Alarm Input 3 (5 V)	White/Blue
P1-13	BTRN	Battery Return for PFTU	Orange
P1-14	N/C	No connection	N/C
P1-15	N/C	No connection	N/C

Note: This connection is jumpered to pin 6 inside the P1 DB-15 connector hood. This connector is used to connect the NT7R87AA T1 CSU Cable Kit.

Table 31 provides the pin assignment relationship between the 8-pin modular jack and the DB-15 connectors to provide a connection between the Local Carrier Interface and Remote Carrier Interface to the CSU.

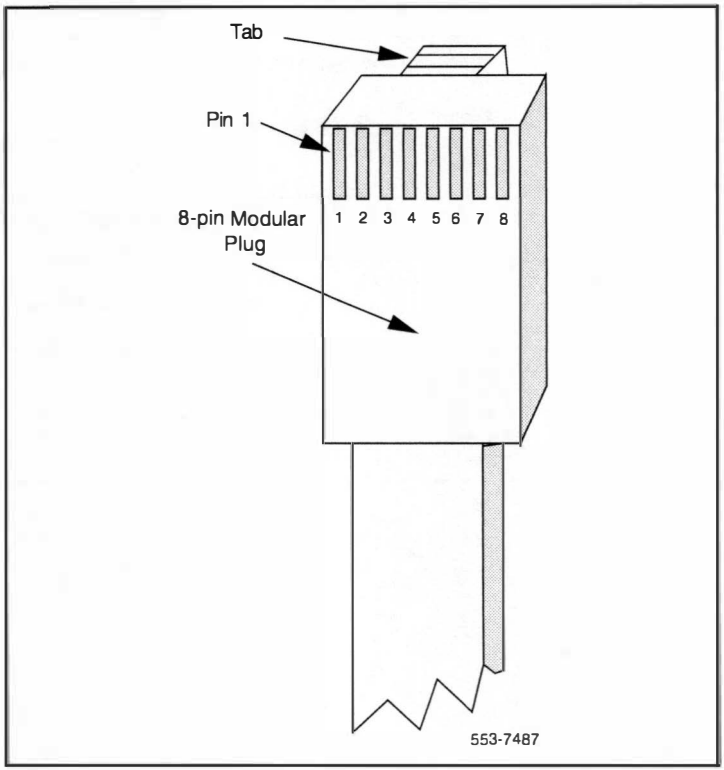
Table 31
Local and Remote Carrier IPE to CSU cable (NT7R87AA) pin assignment

Carrier Panel 8-pin Modular Jack to CSU DB-15 Pin Assignment			
8-pin jack Pins	**DB-15 Pins**	**Signal Name**	**Signal Description**
1	11	RTIPx	Carrier Receive Tip (from network)
2	3	RRINGx	Carrier Receive Ring (from network)
4	9	TRINGx	Carrier Transmit Ring (to network)
5	1	TTIPx	Carrier Transmit Tip (to network)

Note: If the carrier links are just hardwired without using Telco T1 or E1 carrier links, the 8-pin modular plug pins 2 and 1 must be turned over (swapped) with pins 4 and 5 at one end. However, if you are using a T1 or an E1 Telco network, the network provides that turnover.

Figure 32 is showing the 8-pin modular plug pin positions from left to right when the tab is in the back.

Figure 32
RJ48-type 8-pin modular plug pin assignments



Note: If wires are color-coded, hold modular plugs at both ends in the same orientation and verify that the cable is straight through wired when the color-coded wires are in the same pin position for both 8-pin modular plugs. For flat silver satin cable, verify straight through wiring when plug at one end faces up and at the other end faces down. Also verify that pins 1, 2, 4, and 5 are wired at both ends.

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Meridian 1

Carrier Remote IPE

Description, installation, and maintenance

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How the world shares ideas.

Meridian 1

Fiber Remote Multi-IPE Interface

Description, installation, and maintenance

Document Number: 553-3001-022
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About this document

This document is a global document. Contact your system supplier or your Nortel Networks representative to verify that the hardware and software described is supported in your area.

This document is a supplement to Meridian 1 NTPs. It provides information specific to the Meridian 1 implementation of fiber-optic links that connect the Meridian 1 system to multiple Remote IPE modules using a pair of Fiber Remote Multi-IPE Interface units.

It describes the operation of the Fiber Remote Multi-IPE Interface equipment and provides specific information on how to install and maintain this equipment as an integral part of the Meridian 1 system. Fiber Remote Multi-IPE Interface configuration procedures are identical to the equivalent non-fiber equipment in Meridian 1. However, there are some additional software commands that can be executed using the Man-Machine Interface (MMI) terminal to specifically control fiber-optic equipment.

The following describes what you will find in this document:

Product description describes the Fiber Remote Multi-IPE Interface functional and physical characteristics, general engineering guidelines, and planning and ordering information.

Installation and configuration explains how to prepare the site, how to install and connect the Fiber Remote Multi-IPE Interface equipment at Meridian 1 and Remote IPE sites, and how to configure the system using the Man-Machine Interface (MMI) terminal.

Acceptance testing describes how to perform functional tests to verify that the installed Fiber Remote Multi-IPE Interface units are operating correctly.

Maintenance describes how to perform routine administrative and maintenance functions and how to troubleshoot the Fiber Remote Multi-IPE Interface equipment and the fiber-optic link connections. It explains how to isolate problems, fix or replace defective equipment, and verify that the equipment is operating correctly after corrections or replacements have been made.

Appendix lists messages generated by the Peripheral Controller in the Remote IPE equipment. These messages indicate the status of the Peripheral Controller card. It also includes connection diagrams for local and remote sites.

This document provides detailed information on how to install, configure, and maintain the Fiber Remote Multi-IPE Interface equipment. However, it also refers to various Meridian 1 NTPs that contain additional information, which may be required when installing and maintaining the Fiber Remote Multi-IPE Interface and Remote IPE equipment as an integral part of the Meridian 1 system.

Reference

The following is a list of documents that are referred to in this document for additional information:

— *Meridian 1 installation planning (553-3001-120)*

— *Meridian 1 system engineering (553-3001-151)*

— *Meridian 1 power engineering (553-3001-152)*

— *Meridian 1 system installation procedures (553-3001-210)*

— *X11 features and services (553-3001-306)*

— *X11 input/output guide (553-3001-311)*

— *Traffic measurement formats and output (553-2001-450)*

Product description

This chapter describes Fiber Remote Multi-IPE Interface, its architecture, and its hardware options.

It also describes how to plan and engineer a fiber-optic link that connects the local and the remote Fiber Remote Multi-IPE Interface units

System overview

Meridian 1 is a Private Branch Exchange (PBX) that links local subscribers to private and public networks and provides a large number of subscriber functions and features.

In addition to supporting local subscribers, Meridian 1 can be configured using Remote IPE modules as a distributed system that supports remote subscribers. The Remote IPE modules are connected to Meridian 1 at long distances using fiber-optic links at transmission speed at 45 Mbps.

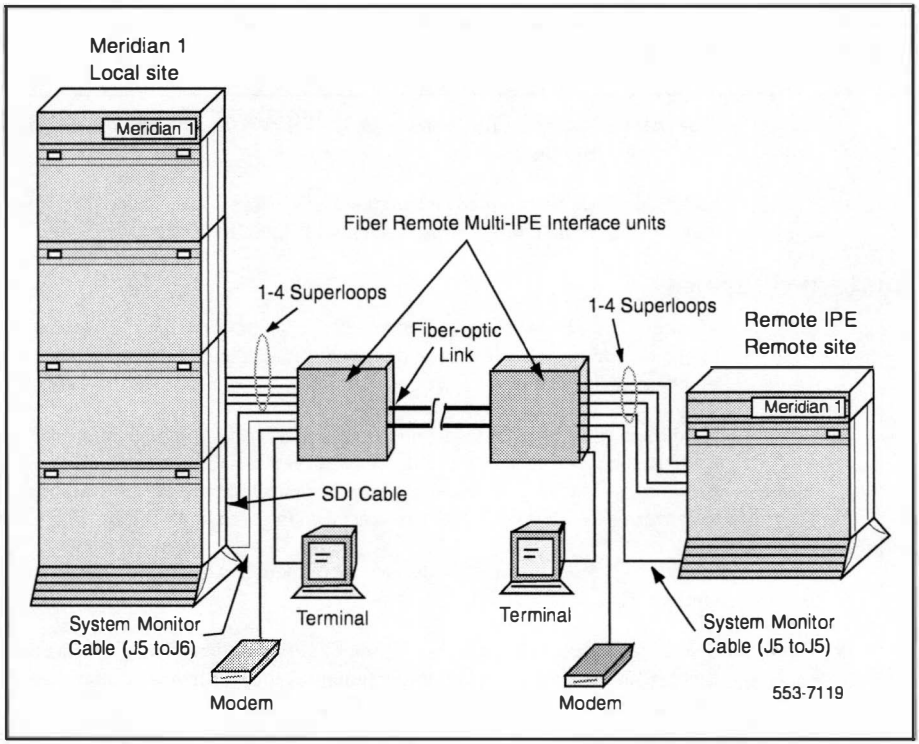
The Fiber Remote Multi-IPE Interface is compatible with Meridian 1 system Options 51C, 61C, and 81C.

Subscriber connections at local Meridian 1 IPE modules are the same as the Remote IPE modules. The subscriber functions and features at the Meridian 1 are also the same as for the Remote IPE site.

This document focuses on the Fiber Remote Multi-IPE Interface equipment specifically designed to provide fiber-optic links between the network functions in Meridian 1 and the peripheral controller functions in the Remote IPE. It also describes how and where to install and how to configure the Superloop Network and Peripheral Controller cards that support the Remote IPE application.

Figure 1 illustrates the Meridian 1 system and the application of the Fiber Remote Multi-IPE Interface and the fiber-optic link to connect the Remote IPE site with the Meridian 1 local site.

Figure 1
Meridian 1 to Remote IPE connection over the fiber-optic link



System description

The Fiber Remote Multi-IPE Interface links Meridian 1 with one or more Remote IPE sites to provide Meridian 1 functionality to these Remote IPE sites. Each Remote IPE shares Meridian 1 common and network equipment to provide the same functions and features to remote subscribers that are available to local Meridian 1 subscribers.

To explain the implementation of Fiber Remote Multi-IPE Interface functions, we will describe:

— Fiber Remote Multi-IPE Interface physical architecture

— Fiber Remote Multi-IPE Interface functional architecture

Fiber Remote Multi-IPE Interface physical architecture

To configure a Meridian 1 system with one or more Remote IPEs, you can install one or more IPE modules at a remote site and connect them to an existing Meridian 1 system using a pair of Fiber Remote Multi-IPE Interface units; one at the local Meridian 1 site and another at the Remote IPE site. These two Fiber Remote Multi-IPE Interface units are connected by a fiber-optic link at a distance of up to 15 miles over a single-mode optical fiber.

Fiber Remote Multi-IPE Interface options

The Fiber Remote Multi-IPE Interface is available in four different options. These are:

— A0634488 Single-mode fiber supporting four superloop

— A0634489 Single-mode fiber supporting two superloops

— A0634490 Multi-mode fiber supporting four superloops

— A0634491 Multi-mode fiber supporting two superloops

These Fiber Remote Multi–IPE Interface options allow you to configure the superloop connections at the remote site the same way they are configured for the IPE modules at the local site. A Superloop Network card can be connected to support one to eight segments in an IPE module the same way it supports them in a local IPE module in the Meridian 1 column. Actually, a Superloop Network card can support a co-located IPE module with, for example, the superloop extended from the faceplate connector J1 and the Remote IPE site with the superloop extended from the faceplate connector J2 at the same time.

Table 1 shows how the superloop connections can be configured and which option Fiber Remote Multi-IPE Interface should be used to connect Meridian 1 to the Remote IPE site. The superloop configuration you select will depend on the traffic requirements at the remote site. If non-blocking is required, three or four superloops for each fully equipped Remote IPE module may be required. If call blocking is not an issue, a single superloop may be used for this application.

Note: Up to four superloop links are supported by a pair of Fiber Remote Multi-IPE Interface units; one unit at each end of the fiber-optic link.

From Table 1 you can conclude that:

— **One segment per superloop**. Requires transmission of four superloop links over the Fiber Remote Multi-IPE Interface and the fiber-optic link to a single Remote IPE module. Note that each Remote IPE module is divided into four segments. Call connections are not blocked.

— **Two segments per superloop.** Requires transmission of two superloop links over the Fiber Remote Multi-IPE Interface and the fiber-optic link to each Remote IPE module. Minimal to no call blocking.

— **Four segments per superloop.** Requires transmission of one superloop link over the Fiber Remote Multi-IPE Interface and the fiber-optic link to each Remote IPE module. Call blocking in high traffic conditions.

— **Eight segments per superloop.** Requires transmission of two superloop links over the Fiber Remote Multi-IPE Interface and the fiber-optic link to two Remote IPE modules. Call blocking in high traffic conditions.

— **One segment for one superloop and three segments for the second superloop**. Requires transmission of two superloops over the Fiber Remote Multi-IPE Interface and the fiber-optic link to a single Remote IPE module. No call blocking for one segment, blocking for the rest.

— **Two segments for one superloop and six segments for another two superloops**. Requires transmission of three superloops over the Fiber Remote Multi-IPE Interface and the fiber-optic link to two Remote IPE modules. Minimal blocking for first four segments in one IPE module and blocking for the last four segments in the second IPE module.

Note: Each segment example in Table 1 is configured over a pair of Remote Multi-IPE Interface units as shown in Figure 1.

Table 1 lists various superloop-to-peripheral controller connection combinations. It shows the connections from the Superloop Network card faceplate connectors J1 and J2 to the Remote IPE backplane connectors SL0 through SL3. Internal cables connect J1 and J2 to the network I/O panel at the Meridian 1 local site and similarly, internal cables connect SL0-SL3 backplane connectors to the Remote IPE I/O panel. From these I/O panels, the external cables connect to the Fiber Remote Multi-IPE Interface units.

Table 1
Superloop connection configurations

Remote IPE Segments per Superloop (Max 4 segments per one IPE module)	Connecting from Meridian 1		Connecting to Remote IPE	
	Superloop Network Card	Faceplate Connector	Controller Card	Backplane Connector
One segment per superloop	NT8D04 #1	J2	NT8D01BC #1	SL0
	NT8D04 #2	J2	NT8D01BC #1	SL1
	NT8D04 #3	J2	NT8D01BC #1	SL2
	NT8D04 #4	J2	NT8D01BC #1	SL3
Two segments per superloop	NT8D04 #1	J2	NT8D01BC #1	SL0
	NT8D04 #2	J2	NT8D01BC #1	SL1
Four segments per superloop	NT8D04 #1	J2	NT8D01BC #1	SL0
Eight segments per superloop	NT8D04 #1	J1	NT8D01BC #1	SL0
	NT8D04 #1	J2	NT8D01BC #2	SL0
One segment per one superloop/three segments per other superloop	NT8D04 #1	J2	NT8D01BC #1	SL0
	NT8D04 #2	J2	NT8D01BC #1	SL1
Two segments per superloop and six segments per another superloop	NT8D04 #1	J2	NT8D01BC #1	SL0
	NT8D04 #2	J2	NT8D01BC #1	SL1
	NT8D04 #2	J1	NT8D01BC #2	SL0

Note: NT8D01BC Controller -4 replaces both NT8D01AC Controller-4 and NT8D01DC Controller-2 for new installations.

Table 2 lists the equipment required to link the Meridian 1 network equipment to the Remote IPE peripheral equipment external to the Meridian 1 column and Remote IPE modules. All the equipment contained in the Meridian 1 column(s) as well as the equipment contained in Remote IPE modules is standard Meridian 1 equipment not specifically design to support the Fiber Remote Multi-IPE Interface and the fiber-optic link.

Table 2
Equipment required to link Meridian 1 to Remote IPE sites (Part 1 of 3)

Component	Description
A0634488 Fiber Remote Multi–IPE Interface Unit	Supports **single-mode** fiber-optic link for four superloops at connector positions **SUPERLOOP-1** through **SUPERLOOP-4**.
A0634489 Fiber Remote Multi–IPE Interface Unit	Supports **single-mode** fiber-optic link for two superloops at connector positions **SUPERLOOP-1** and **SUPERLOOP-2**.
A0634490 Fiber Remote Multi–IPE Interface Unit	Supports **multi-mode** fiber-optic link for four superloops at connector positions **SUPERLOOP-1** through **SUPERLOOP-4**.
A0634491 Fiber Remote Multi–IPE Interface Unit	Supports **multi-mode** fiber-optic link for two superloops at connector positions **SUPERLOOP-1** and **SUPERLOOP-2**.
A0634492 Fiber Remote Multi–IPE Interface Redundant Option	A daughterboard with fiber-optic connectors that is installed onto the motherboard to supports **single-mode** redundant fiber-optic link operation.
A0634493 Fiber Remote Multi–IPE Interface Redundant Option	A daughterboard with fiber-optic connectors that is installed onto the motherboard to supports **multi-mode** redundant fiber-optic link operation.
A0634494 Fiber Remote Multi–IPE Rack-Mounted Shelf	Supports up to six Fiber Remote Multi-IPE Interface units per shelf. Used where several units are co-located to save space. Usually at the Meridian 1 site (Optional).

Table 2
Equipment required to link Meridian 1 to Remote IPE sites (Part 2 of 3)

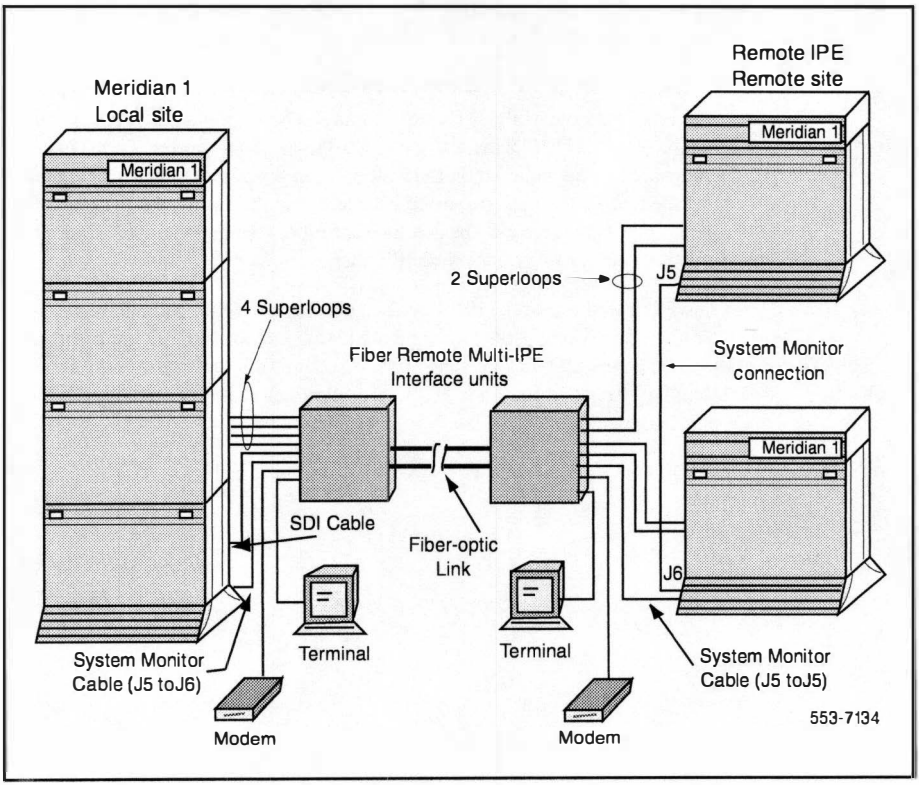
Component	Description
A0634495 Local Fiber Remote Multi-IPE Interface Cable	A 30 foot shielded cable connects the local Meridian 1 network I/O panel 24-pin Centronics connector to a Fiber Remote Multi-IPE Interface unit SUPERLOOP 37-pin D Shell connector.
A0634496 Remote Fiber Remote Multi-IPE Interface Cable	A 30-foot shielded cable connects the Remote IPE I/O panel 24-pin Centronics connector to a Fiber Remote Multi-IPE Interface unit SUPERLOOP 37-pin D Shell connector.
A0634497 Maintenance Interface Cable	A 2-foot DB-9 male to DB-9 female cable daisy-chains multiple co-located Fiber Remote Multi-IPE Interface units to share a common maintenance terminal. The male cable connector plugs into the SDI connector and the female cable connector plugs into the MAINT connector in the I/O panel at the rear of the Fiber Remote Multi-IPE Interface units.
A0634498 AC/DC Power Converter	A wall-mounted -48 Volt DC power converter with a 25-foot power cable is provided with each Fiber Remote Multi-IPE Interface unit.
A0654976 DC Power Cable	DC 25-foot power cable that is connected between a -48 V system power source and the Fiber Remote Multi-IPE Interface unit
A0654977 Attenuated Fiber Loopback Cable	Fiber-optic cable used to loopback at the ST fiber-optic connectors on the faceplate.
NT7R66AA SDI Cable Kit	This cable kit provides a 10-foot DB-9 male to DB-25 male cable and a DB-25F/DB-25F compact adapter. To connect the standard SDI card to the DB-9 female SDI connector of the Fiber Remote Multi-IPE Interface unit, use the cable but not the DB-25F/DB-25F adapter. To connect the SDI Paddleboard use the entire kit including the adapter. This kit is used together with the NT8D93AJ cable for the Paddleboard.

Table 2
Equipment required to link Meridian 1 to Remote IPE sites (Part 3 of 3)

Component	Description
NT7R66BA MMI Cable	This is a 32-foot DB-9 female to DB-25 male cable. Connect the MMI terminal to the DB-9 male MAINT port on the Fiber Remote Multi-IPE Interface unit.
NT8D46AL System Monitor daisy-chain cable (Similar cable may be purchased in any telephone equipment shop).	Connects RJ11 connectors XSM IN and XSM OUT daisy-chaining Fiber Remote Multi-IPE Interface units. This RJ11 phone cable has reverse leads: Black (2), Red (3), Green (4), Yellow(5) at one end of the cable and Yellow (2), Green (3), Red (4), Black (5) at the other end of the cable.
NT8D46AP System Monitor Serial Link Cable	Connects the 6-pin modular jack J5 on the Fiber Remote Multi-IPE I/O panel to the system monitor jack J6 in the pedestal.
NT8D88AD Network to I/O Panel Cable	A 6-foot cable that connects Superloop Network card J1 or J2 faceplate connectors to the network I/O panel.
NT8D92AD Controller to I/O Panel Cable	A 20-inch cable that connects one of the IPE backplane connectors SL0, SL1, SL2, or SL3 to the IPE I/O panel.
NT8D93AJ XSDI I/O to DTE or DCE Cable	Connects the Paddleboard DB-9 female connector to the an adapter cable that ultimately connects to the Fiber Remote Multi-IPE Interface unit.

Figure 2 illustrates Meridian 1 and Remote IPE equipment linked with fiber-optic cable over Fiber Remote Multi-IPE Interface units. Connections between Meridian 1 and Fiber Remote Multi-IPE Interface units depend on the number of superloops projected over the fiber-optic link to the Remote IPE modules at one or more remote sites. This figure shows two IPE Modules supported at the remote site. A maximum of four IPE Modules can be supported using a pair of Fiber Remote Multi-IPE Interface units.

Figure 2
Meridian 1 to Remote IPE connection over fiber-optic links



A maximum number of four superloops can be supported by a Fiber Remote Multi-IPE Interface unit. The transmission of these four superloops is handled by a single transmit and a single receive fiber-optic link in a non-redundant configuration. The primary ST-type fiber-optic connectors on the Fiber Remote Multi-IPE Interface faceplate are labeled XMIT A and RCV A.

In the redundant configuration, an additional set of fiber-optic transmit and receive connectors are added to the Fiber Remote Multi-IPE Interface motherboard by installing a daughterboard into the unit. These redundant ST-type fiber-optic connectors on the Fiber Remote Multi-IPE Interface faceplate are labeled XMIT B and RCV B.

Fiber Remote Multi-IPE Interface unit

The Fiber Remote Multi-IPE Interface unit is housed in a metal enclosure measuring 10.4x12x12 inches or (26.42x38.48x38.48 centimeters). This enclosure can be mounted on the wall or up to six of these enclosures can be installed into a 19-inch rack-mounted shelf. The shelf is normally used at the local site where there may be a number of Fiber Remote Multi-IPE Interface units supporting several Remote IPE sites.

The Fiber Remote Multi-IPE Interface unit has a faceplate that contains the ST-type fiber-optic connectors and the alarm and power LED indicators. At the rear of the unit an I/O panel contains connectors that connect the Fiber Remote Multi-IPE Interface unit to the Meridian 1 and the Remote IPE I/O panel connectors.

Figure 3 illustrates the front view of the Fiber Remote Multi-IPE Interface unit. It shows primary and redundant fiber-optic connectors to support a redundant fiber-optic link. It also shows the power and alarm indicator LEDs. The ejector tabs are used to eject the card. You can then access the motherboard to install the daughterboard or to set configuration switches.

Figure 3
Fiber Remote Multi-IPE Interface faceplate

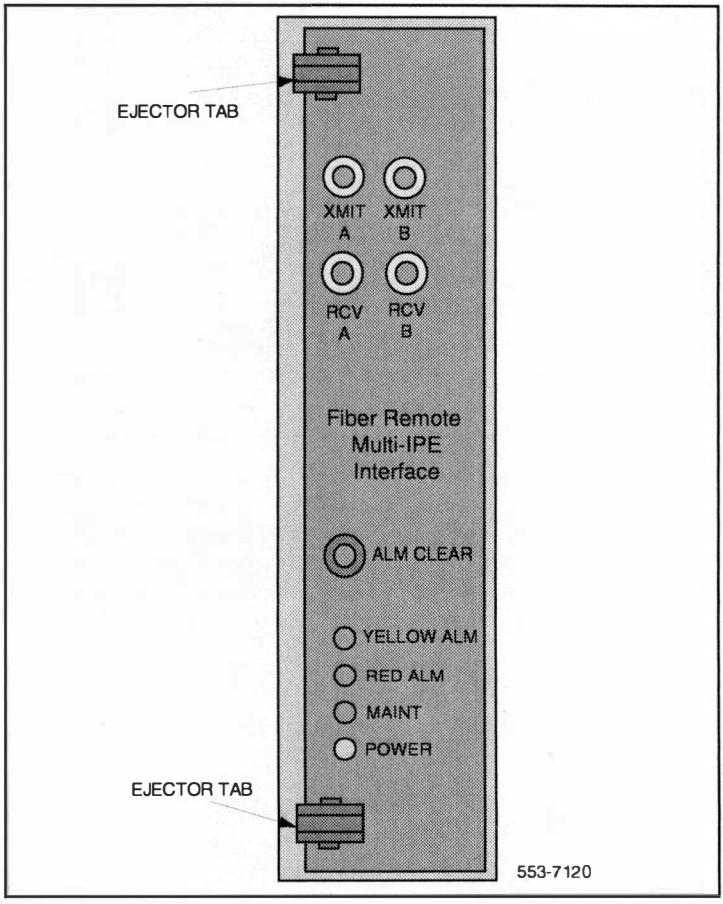
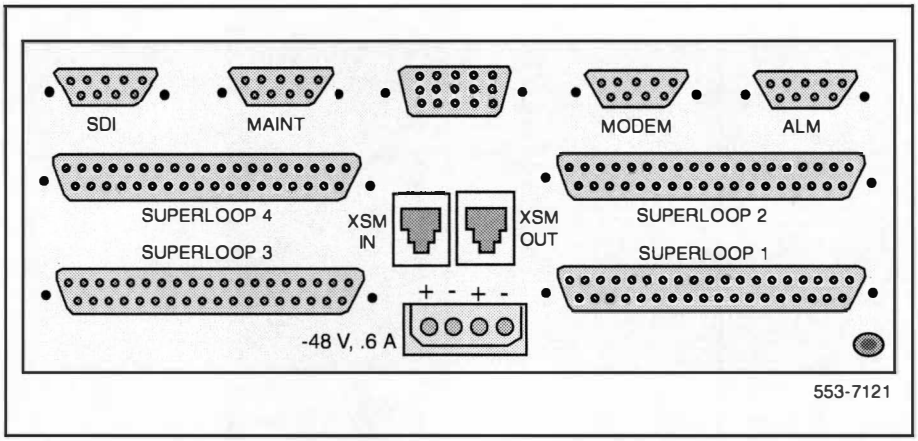


Figure 4 illustrates the rear view of the Fiber Remote Multi-IPE Interface unit. It shows the Fiber Remote Multi-IPE Interface unit I/O panel. The I/O panel contains connectors to connect the superloop cables, the system monitor cables, the SDI port, the MMI terminal, the modem, the external alarms, and the power.

Figure 4
Fiber Remote Multi-IPE Interface unit I/O panel-rear view



The Fiber Remote Multi-IPE Interface I/O panel connectors interface with the Meridian 1 and Remote IPE equipment over copper cables. The SDI and the MAINT connectors can also be used to daisy-chain multiple Fiber Remote Multi-IPE Interface units to provide common MMI terminal and SDI connections for all Fiber Remote Multi-IPE Interface units in the chain.

Table 3 lists all the Fiber Remote Multi-IPE Interface I/O panel connectors and describes their functions.

Table 3
Fiber Remote Multi-IPE Interface I/O panel connectors

Connector Name	Connector Type	Connector Function
SDI	DB-9 female	Connects to the SDI port in Meridian 1 or in a daisy-chain, to the MAINT connector of the preceding Fiber Remote Multi-IPE Interface unit.
MAINT	DB-9 male	Connects to the MMI terminal or in a daisy-chain to the SDI connector of the following Fiber Remote Multi-IPE Interface unit.
MODEM	DB-9 female	Connects to a modem for remote maintenance access to the Remote IPE. It can be connected at the local and at the remote site.
ALM	DB-9 male	Connects to external alarm devices.
XSM IN (J5)	6-pin modular jack	Connects to the XSM OUT (J6) jack on the upstream Fiber Remote Multi-IPE Interface unit, or Remote IPE system monitor.
XSM OUT (J6)	6-pin modular jack	Connects to the master system monitor J6 modular jack located in the Meridian 1 pedestal or the XSM IN (J5) jack or the downstream Fiber Remote Multi-IPE Interface unit.
SUPERLOOP-1 through SUPERLOOP-4	37-pin D Shell, male	Connect to the Meridian 1 network I/O panel or Remote IPE I/O panel 24-pin connectors.

Fiber Remote Multi-IPE functional architecture

The Fiber Remote Multi-IPE Interface converts a superloop format into a fiber-optic format and the fiber-optic format to the superloop format. Since this is a bidirectional link, the communication and signaling information flows from Meridian 1 to the Remote IPE site and form the Remote IPE site to Meridian 1.

To enhance the transmission reliability, the Fiber Remote Multi-IPE Interface can be equipped with a redundant fiber-optic link, which is automatically selected to carry traffic if the primary fiber-optic link fails.

The main functions of the Fiber Remote Multi-IPE Interface:

— Supports a fiber-optic link between the Meridian 1 and the Remote IPE over a pair of single-mode or multi-mode fibers.

— Monitors link performance and automatically switches from the primary to the redundant link if the primary link fails, if equipped.

— Provides system maintenance over the fiber-optic link in both directions.

— Performs diagnostic testing of the fiber-optic link and the superloops.

— Reports system monitor information from the Remote IPE sites to the Meridian 1.

Fiber-optic interface

The Fiber Remote Multi-IPE Interface links multiple Remote IPE sites with the Meridian 1 system over a single-mode or multi-mode optical fibers. With multi-mode fiber-optic link, the maximum distance between Meridian 1 and the Remote IPE site is approximately 6 miles. With a singe-mode fiber-optic link, the maximum distance is approximately 15 miles. The actual distance depends on the quality of the fiber-optic cable and cable splices.

The Fiber Remote Multi-IPE Interface provides ST-type optical connectors, which are compatible with multi-mode fibers at 62.5um/125 um (micrometer) or with the single-mode fibers at 8.3 um/125 um.

A redundant fiber-optic link is optionally available on the Fiber Remote Multi-IPE Interface to provide greater transmission reliability between Meridian 1 and the Remote IPE sites. The Fiber Remote Multi-IPE Interface automatically transfers the communication to the redundant link when the primary link fails. When the primary link problem is corrected, it becomes the spare link and the transmission does not switch to it until the currently active link fails.

The Fiber Remote Multi-IPE Interface optical interface functions:

— Provides a single or a redundant dedicated optical link to connect the Remote IPE to Meridian 1.

— Monitors fiber-optic link integrity and transmission quality and provide automatic link switching from the failed primary link to the redundant link, if equipped.

— Provides local and remote loopback testing of the fiber-optic link by using a fiber-optic cable to loop the fiber-optic interface at either end of the fiber-optic link.

Superloop interface

The Fiber Remote Multi-IPE Interface is equipped with four superloop network connectors. These are 37-pin D Shell connectors that are used to directly connect the Fiber Remote Multi-IPE Interface to the Meridian 1 network I/O panel or the Remote IPE I/O panel 24-pin Centronics connectors. The Fiber Remote Multi-IPE Interface can accommodate from one to four superloops depending on the type selected. For types of Fiber Remote Multi-IPE Interface, refer to Table 2 "Equipment required to link Meridian 1 to Remote IPE sites" on page 14.

Each superloop supports 120 time slots for voice and data. Eight additional time slots are used to carry out-of-band signaling and messaging information across the fiber-optic link.

Table 1 "Superloop connection configurations" on page 13 list various combination of superloop connections to the Fiber Remote Multi-IPE Interface. The flexibility of superloop use allows for system optimization, which depends on the specific system configuration and traffic requirements.

Maintenance functions

The Fiber Remote Multi-IPE Interface provides a DB-9 female (MAINT) connector at the rear of the unit on the I/O panel. This connector is used as the MMI terminal port at both the local and the remote sites.

This MMI terminal is used to perform the following functions:

— Configuration of the fiber-optic link performance criteria, such as bit error rate threshold

— On-line and off-line diagnostic testing of the fiber-optic link and superloops

— Retrieval of performance statistics such as alarm log, error log, and current performance statistics

— Clear error log files and alarms

— Set time, date, and also sets the name of the site and of the superloop links

The SDI connector, also located on the Fiber Remote Multi-IPE Interface I/O panel, is used to connect the Fiber Remote Multi-IPE Interface to an SDI card in the Meridian 1 system. An MMI terminal at the Meridian 1 local site or at a Remote IPE site can access the system through this SDI port at the Meridian 1 site and perform configuration, maintenance, and test functions of the Meridian 1 system.

A modem port (MODEM) is also provided on the I/O panel. This DB-9 female connector connects a modem to the Fiber Remote Multi-IPE Interface. The modem is used to connect an MMI terminal, which may be located at a maintenance center. This maintenance center may be located in a different city, but by using a modem and public or private telephone facilities, it is able to access the Fiber Remote Multi-IPE Interface equipment at the local and the remote sites. It can also access the Meridian 1 SDI port for Meridian 1 system maintenance. This access is allowed only to the system TTY and the MMI terminals directly connected to the Fiber Remote Multi-IPE Interface MAINT port.

A Fiber Remote Multi-IPE Interface in a multiple unit configuration, can be accessed by logging in on an MMI terminal. An MMI terminal can then access Meridian 1 for system maintenance or a Fiber Remote Multi-IPE Interface at the local or remote sites for maintenance and diagnostic testing and reporting. Only one Fiber Remote Multi-IPE Interface can be accessed at a time. To access an other Fiber Remote Multi-IPE Interface, the current session has to be terminated and a different Fiber Remote Multi-IPE Interface unit can then be accessed by logging in again.

The Fiber Remote Multi-IPE Interface supports the maintenance port transmission speed of 2400 baud.

If multiple Fiber Remote Multi-IPE Interface units are co-located at a site, usually at the local Meridian 1 site, you can daisy-chain Fiber Remote Multi-IPE Interface units to allow a single MMI terminal to access any Fiber Remote Multi-IPE Interface unit in the chain. This is accomplished by daisy-chaining the MAINT and the SDI ports on each Fiber Remote Multi-IPE Interface unit.

The SDI port of the first Fiber Remote Multi-IPE Interface in the daisy-chain can be optionally connected to an SDI port on the SDI card in Meridian 1. The MAINT port in the last Fiber Remote Multi-IPE Interface in the daisy-chain is connected to the MMI terminal.

Fiber Remote Multi-IPE Interface units in a daisy-chain have unique addresses, which are set by a dip-switch setting on the motherboard. This allows you to select a specific Fiber Remote Multi-IPE Interface in the chain when you log in on the MMI terminal to perform configuration, maintenance, or testing of that Fiber Remote Multi-IPE Interface unit.

System monitor interface

The system monitor card resides in the Meridian 1 and Remote IPE pedestals. It monitors the power and the temperature in all modules in the Meridian 1 column and in the Remote IPE column. The master system monitor is located in the Meridian 1 common equipment pedestal. It receives the information from modules in its own column, from the slaves system monitors located in other co-located columns, and from each Remote IPE system monitor over the fiber-optic link.

The Fiber Remote Multi-IPE Interface I/O panel provides two 6-pin modular jacks, which are used to connect the system monitor to the Fiber Remote Multi-IPE Interface for transmission of power and temperature status from the Remote IPE to the Meridian 1 over the fiber-optic link.

If multiple Fiber Remote Multi-IPE Interface units are co-located at the local site, these units are daisy-chained by connecting the XSM OUT modular jack of one Fiber Remote Multi-IPE Interface unit to the XSM IN modular jack of the other unit in the chain. Only one Fiber Remote Multi-IPE Interface unit 6-pin XSM IN (J5) modular jack is connected to the J6 of the master system monitor or a slave system monitor that is hierarchically higher than the highest Fiber Remote Multi-IPE Interface unit connected to it.

At the Remote IPE site, the system monitor J5 modular jack is connected to the J5 XSM IN modular jack of the corresponding Fiber Remote Multi-IPE Interface unit. The information from the system monitor is transmitted over the fiber-optic link to the local site Fiber Remote Multi-IPE Interface unit. If multiple Fiber Remote Multi-IPE Interface units are co-located at the local site, they are daisy-chained and only one Fiber Remote Multi-IPE Interface unit is connected to the local master system monitor or to a slave system monitor hierarchically higher than the highest Fiber Remote Multi-IPE Interface unit.

Diagnostic functions

The Fiber Remote Multi-IPE Interface provides diagnostic functions to monitor the equipment performance and to automatically issue an alarm that corresponds to the type of fault detected. The alarm may be issued in the form of an lit LED, a message displayed on the MMI terminal or system maintenance terminal, a printed error report, or a combination of these fault indicators.

The Fiber Remote Multi-IPE Interface system diagnostics consist of:

— Background diagnostics

— On-line diagnostics

— Off-line diagnostics

Background diagnostic routine continuously monitors the fiber-optic link and the superloop timeslots for error conditions, loss of clock, loss of signal, and loss of frame.

When the fiber-optic link fails or the superloop shows an error condition, a normally open alarm relay contact will close activating an alarm, an LED is lit at each end of the fiber-optic link, an error report is displayed on the maintenance terminal at each end of the link, and an entry is made in the Fiber Remote Multi-IPE Interface system alarm log indicating time, date, location, and type of alarm. A RED ALARM indicates that an error was detected at this side of the fiber-optic link and a YELLOW ALARM indicates that the error condition was detected at the opposite side of the fiber-optic link.

The Fiber Remote Multi-IPE Interface can be configured to automatically clear the alarm condition when the problem clears, or it can be configured to continue to indicate the alarm condition until is cleared by a command over the MMI terminal or by pressing the ALM CLEAR button on the Fiber Remote Multi-IPE Interface unit faceplate at the local or the remote site.

On-line diagnostics does not interfere with the normal system operation and is performed on an active link.

Off-line diagnostics may interfere with the normal system operation and is performed on an idle or faulty fiber-optic link or a disabled superloop. To minimize the impact of off-line testing, a superloop should first be software disabled and then tested while the other superloops are carrying traffic.

The off-line diagnostic testing can perform loopback tests of the superloop data, clock and frame signals, and on the fiber-optic link.

Commands can be issued over the MMI terminal to specify the superloop that should be tested and the duration of the test. Multiple superloops can be simultaneously tested, if so desired.

To perform loopback testing of the fiber-optic link, an attenuated loopback fiber-optic cable must be used at the end of the link that is being looped back. This test is used to verify the performance of the fiber-optic link and the Fiber Remote Multi-IPE Interface unit fiber-optic interface circuits.

Card-LAN interface

The Card-LAN is a 19.2 kbps asynchronous interface. It is used to poll peripheral equipment lines and communicate over the fiber-optic link to transmit maintenance messages between the Superloop Network card and the Peripheral Controller. These messages include:

— LED control of the IPE card enable/disable

— peripheral card configuration

— peripheral card type and version information

Alarms and LED indicators

The Fiber Remote Multi-IPE Interface provides LED indicators and external alarm connections to enable error detecting and external alarm reporting.

External alarm indicators. The Fiber Remote Multi-IPE Interface unit I/O panel contains the DB-9 female ALM connector to connect the external alarms to the Fiber Remote Multi-IPE Interface unit.

The connector provides:

— Three external alarm outputs on each local Fiber Remote Multi-IPE Interface unit

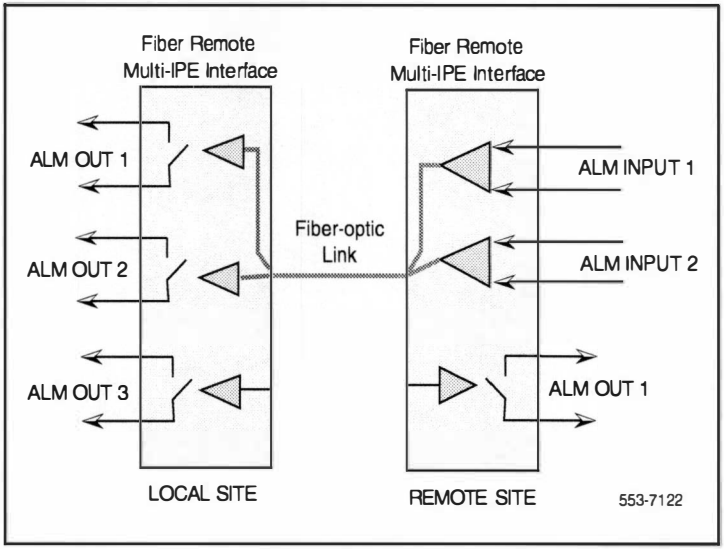
— Two external alarm inputs and one external alarm output on each remote Fiber Remote Multi-IPE Interface unit

The two external alarm inputs (alarm input #1 and #2), when activated, are transmitted from a remote Fiber Remote Multi-IPE Interface over the fiber-optic link to the local Fiber Remote Multi-IPE Interface to activate two out of three external alarm outputs (alarm outputs #1 and #2) on the local Fiber Remote Multi-IPE Interface unit. At the local site the alarm output #3 is activated when the fiber-optic link detects an alarm condition.

The single alarm output at the remote Fiber Remote Multi-IPE Interface will be activated if an external alarm is activated or if the fiber-optic link detects an alarm condition.

Figure 5 illustrates the external alarm inputs at the remote Fiber Remote Multi-IPE Interface location and the corresponding alarm outputs at the local Fiber Remote Multi-IPE Interface connected to Meridian 1.

Figure 5
External alarm inputs and outputs



LED indicators. The LED indicators are located on the faceplate of each Fiber Remote Multi-IPE Interface unit. These LEDs are:

— Power LED. Indicates that the Fiber Remote Multi-IPE Interface passed self-test and the AC/DC power converter powering the Fiber Remote Multi-IPE Interface is operating correctly.

— Red Alarm LED. Indicates a near end fault condition. This near-end fault condition activates the Yellow Alarm LED at the far-end Fiber Remote Multi-IPE Interface.

— Yellow Alarm LED. Indicates a far-end alarm condition. This alarm LED is activated by a far-end fault condition (when the Red Alarm LED is activated at the far-end).

— Maintenance In Progress LED. Indicates that a function in the fiber-optic link or one or more superloops have been disabled using maintenance commands. The LED will also be lit if a service-effecting off-line diagnostic test is in progress.

Engineering guidelines

Meridian 1 general system engineering guidelines are described in *Meridian 1 system engineering (553-3001-151)*. The following information deals specifically with engineering guidelines for the Fiber Remote Multi-IPE Interface planning and implementation. It also describes the fiber-optic interface specifications and fiber-optic link characteristics.

Remote IPE capacity

Meridian 1 physical capacity depends on the system's configuration and size. System options 51C, 61C, and 81C are designed to provide port capacities from tens to thousands of ports. These ports are normally local to Meridian 1, however, by implementing Fiber Remote Multi-IPE Interface, many of these ports can be located at one or more remote sites.

The overall maximum system capacity does not change by installing Fiber Remote Multi-IPE Interface units to support distributed peripheral equipment (subscriber loops) at Remote IPE sites. Fiber Remote Multi-IPE Interface allows you to distribute the peripheral equipment at long distances from Meridian 1 and provide the same functions and features to remote subscribers as to local subscribers.

The Fiber Remote IPE capacity can be tailored according to port capacity requirements at the remote site. When planning a Remote IPE site, you must determine the number of IPE cards required to support the existing and future traffic needs and the call blocking tolerance.

A Remote IPE column consists of the Meridian 1 pedestal, from one to four IPE modules, and a top cap. One IPE module supports up to 16 line cards, or 256 ports if each line card has 16 ports (other IPE cards may have a different number of ports). If more ports are required, additional IPE modules can be added to the column. A column contains a maximum of four IPE modules providing a maximum of 1024 subscriber loops. Each IPE module requires one Peripheral Controller card located in the IPE module *Cont* card slot and a corresponding one to four superloops provided in Meridian 1 by the Superloop Network card(s).

Depending on the number of superloops required, the type of optical fiber used in the link, the appropriate Fiber Remote Multi-IPE Interface unit must be selected from Table 2 "Equipment required to link Meridian 1 to Remote IPE sites" on page 14.

The number of superloops required to support a Remote IPE module depends on the traffic requirements. If a non-blocking traffic condition is required, the Remote IPE module requires a minimum of three superloops. Each superloop supports 120 time slots or 7 line cards. To support 16 line cards, three or fours superloops should be used. If traffic blocking is not an issue, one superloop will be sufficient to support one Remote IPE module.

Engineering the fiber-optic link

A fiber-optic link can be constructed using single-mode or multi-mode fiber-optic cables. The type of fibers you select will depend on various factors:

— distance between Meridian 1 and the Remote IPE site

— possible existence of a fiber-optic link you wish to use for this application

— cost and availability of fiber-optic cables

Single-mode Fiber Remote Multi-IPE Interface units are compatible with multi-mode fiber-optic link at the appropriately calculated attenuation limits. However, multi-mode Fiber Remote Multi-IPE Interface units are not compatible with the single-mode fiber-optic link.

When engineering a fiber-optic link, you must consult the component manufacturer's data sheets to determine whether the cable, connectors, and other components meet the transmission characteristics and the signal loss plan for the transmission distance required for your specific Remote IPE application.

Fiber-optic interface specification

When planning a fiber-optic link, you must consider the transmit and receive signal power and the signal attenuation of each component in the link to determine total signal attenuation.

Table 4 shows the transmit and receive signal power level at the signal source and the signal destination. The receive circuit on the electro-optical interface will detect a signal at a level as low as –30 dBm.

Table 4
Fiber-optic transmit and receive signal levels

Signal source	Transmitted power	Received power
	Min	Min
Fiber Remote Multi-IPE Interface	–15 dBm	–30 dBm

Fiber-optic link loss characteristics

The fiber-optic link components add to the total end-to-end link signal attenuation. The fiber-optic cable attenuation depends on the type of cable selected. The manufacturer's data sheet provides parameter values, which must be considered when engineering the link. In addition, the signal attenuation is also affected by the number of splices in the link and the signal loss in the link terminating the fiber-optic connectors.

Table 5 shows an example of different fiber-optic link components and the total signal attenuation for a 10 km link of 10.2 dB for a high quality single-mode fiber.

Table 5
Example of fiber-optic link components and their attenuation factors

Component	Quantity	Attenuation in (dB)	Total attenuation in (dB)
High quality single-mode fiber (10 km)	1	0.5/km	5.0
Medium quality splices	10	0.2/splice	2.0
ST connector pairs	4	0.8/connector pair	3.2

Note: XMIT A and RCV A connector pairs on the faceplate do not count when calculating the attenuation across the link.

Maximum calculated signal attenuation across the link is 10.2 dB, which allows 4.8 dB safety margin for a single-mode fiber.

Note: Actual attenuation must be determined by measuring the end-to-end signal loss. Because of the 45 Mbps data rate, dispersion loss is not a factor with either single-mode or multi-mode fibers. With good quality cable and splices, the Remote IPE modules can be located up to 15 miles from the network module for single-mode fibers and up to 6 miles for the multi-mode fibers. A safety margin for the attenuation loss is designed into the Fiber Remote Multi-IPE Interface unit over the specified usable power budget.

Fiber-optic cable types

If a fiber-optic link already exists, it must be evaluated to determine if it will support the Fiber Remote Multi-IPE Interface and, if it will, at what distance from Meridian 1. The distance of the link can be determined by finding a point of the fiber-optic link where the signal loss is less than 15 dB for a given transmission rate over a single-mode fiber and less than 10 dB for the multi-mode fiber.

To evaluate an existing link, measure the end-to-end attenuation to determine the link's suitability for the Fiber Remote Multi-IPE Interface application.

A fiber-optic link may be composed of single-mode or multi-mode fibers, splices, and fiber-optic connectors. ST-type fiber-optic connectors have to be installed onto fibers of the fiber-optic link cables so that the link can be directly connected to the ST-type fiber-optic connectors on the Fiber Remote Multi-IPE Interface unit faceplate.

Fiber-optic link calculation examples

The following fiber-optic link calculations for both single-mode and multi-mode fibers illustrates how to evaluate the distance of a link based on the type of fiber and attenuation of the fiber and splices.

Example 1 - Medium quality multi-mode fiber-optic cable and splices

Medium quality multi-mode fiber-optic cable has a loss of 1.5 dB per km. Medium quality splices have 0.5 dB loss per splice.

Assumptions:

— dB loss allowed over multi-mode fiber by the Fiber Remote Multi-IPE Interface: 10 dB

— dB loss per km of fiber: 1.5 dB

— dB loss per splice: 0.5 dB

Assume a 5 km length of fiber link made from five 1 km lengths of fiber-optic cable with four splices in the cable (one splice every 1 km).

Calculations:

dB loss = (5km) x (1.5 dB per km) + (4 splices) x (0.5 dB per splice)

dB loss = 7.5 dB + 2.0 dB = 9.5 dB

Safety margin = 10 dB - 9.5 dB = 0.5 dB

Example 2 - High quality multi-mode fiber-optic cable and splices

High quality multi-mode fiber-optic cable provides a loss of 1.0 dB per km. High quality splices provide 0.1 dB loss per splice.

Assumptions:

— dB loss allowed over multi-mode fiber by the Fiber Remote Multi-IPE Interface: 10 dB

— dB loss per km of fiber: 1.0 dB

— dB loss per splice: 0.1 dB

Assume a 9 km length of fiber made from nine 1 km lengths of cable with eight splices in the cable (one splice every 1 km).

Calculations:

dB loss = (9km) x (1.0 dB per km) + (8 splices) x (0.1 dB per splice)

dB loss = 9.0dB + 0.8 dB = 9.8 dB

Safety margin = 10 dB - 9.8 dB = 0.2 dB

Example 3 - Medium quality single-mode cable and splices

Medium quality single-mode cable provides a loss of 1.0 dB per km. Medium quality splices provide 0.2 dB loss per splice.

Assumptions:

— dB loss allowed over single-mode fiber by the Fiber Remote Multi-IPE Interface: 15 dB

— dB loss per km of fiber: 1.0 dB

— dB loss per splice: 0.2 dB

Assume a 12 km length of fiber made from twelve 1 km lengths of cable with eleven splices in the cable (one splice every 1 km).

Calculations:

dB loss = (12km) x (1.0 dB per km) + (11 splices) x (0.2 dB per splice)

dB loss = 12.0dB + 2.2 dB = 14.2 dB

Safety margin = 15 dB - 14.2 dB = 0.8 dB

Example 4 - High quality single-mode cable and splices

High quality single-mode cable provides a loss of 0.5 dB per km. High quality splices provide 0.1 dB loss per splice.

Assumptions:

— dB loss allowed over single-mode fiber by the Fiber Remote Multi-IPE Interface: 15 dB

— dB loss per km of fiber: 0.5 dB

— dB loss per splice: 0.1 dB

Assume a 25 km length of fiber made from twenty-five 1 km lengths of cable with twenty-four splices in the cable (one splice every 1 km).

Calculations:

dB loss = (25km) x (0.5 dB per km) + (24 splices) x (0.1 dB per splice)

dB loss = 12.5dB + 2.4 dB = 14.9 dB

Safety margin = 15 dB - 14.9 dB = 0.1 dB

System selection

In some applications where non-blocking or low blocking traffic considerations are important, you have to limit the number of peripheral cards supported by each superloop. For a non-blocking condition, the 120 voice/data time slots (one superloop) will support seven or eight 16-port line cards. Each additional line card in the IPE module increases call blocking under high traffic conditions. Refer to *Meridian 1 system engineering (553-3001-151)* to calculate traffic.

A Remote IPE module supports 16 line cards and provides a maximum of 256 ports (different IPE cards provide different number of ports). This column may be expanded by adding more IPE modules to support an additional ports. Each IPE module requires a Peripheral Controller card at the remote site and a corresponding one to four Superloop Network cards at the local Meridian 1 site.

In addition to line cards, the Remote IPE supports all the cards that do not require external connection to Meridian 1 common or network equipment.

Remote IPE site planning

When you select a site for your Remote IPE, you must consider the number of ports currently required at the site and the possibility of expansion to meet future needs. You also must consider environmental, power, and cable routing requirements.

Environmental requirements

The Fiber Remote Multi-IPE Interface conforms to the same environmental requirements as the rest of the Meridian 1 equipment. Temperature, humidity, and altitude for Meridian 1 equipment operation should not exceed the specifications shown in Table 6.

Table 6 shows the operating and storage environmental specifications. Ideally Meridian 1 equipment should operate in a stable environment at 22° C (72° F); however, the system is designed to operate in the temperature and humidity ranges specified in the table.

Table 6
Environmental requirements

Condition	Environmental specifications
Operating	
Temperature	0° to 50° C (32° to 122° F)
Relative humidity	5% to 95% noncondensing
Altitude	3,048 meters (10,000 feet) max
Storage	
Temperature	–50° to 70° C (–58° to 158° F)
Relative humidity	5% to 95% noncondensing

Power requirements

Power for the Remote IPE modules is provided by the power converter in each module.

The Fiber Remote Multi-IPE Interface requires -48 V DC at 0.6 Amps. An AC/DC power converter is optionally shipped with each Fiber Remote Multi-IPE Interface unit to provide the required power for the Fiber Remote Multi-IPE Interface unit. This power converter is wall-mounted next to the Fiber Remote Multi-IPE Interface unit.

A DC power source for the Fiber Remote Multi-IPE Interface unit is a -48 V also used by the Meridian 1 system or the Remote IPE column. This source is usually available if the system is DC-powered or has a DC backup power source.

Installation and configuration

This chapter describes the installation of the Fiber Remote Multi-IPE Interface unit as a part of a fiber-optic link connecting Meridian 1 to its Remote IPE modules at distances of up to 15 kilometers. It explains how to prepare the site and check the equipment before installing it and how to configure it to the specific traffic requirements.

Quick reference to system installation and configuration

If you are familiar with the system operation and general Meridian 1 installation practices, follow the steps below to speed up the installation of the Fiber Remote Multi-IPE Interface and the Remote IPE at the local and remote sites:

1 Take inventory of the equipment by comparing the received equipment against the shipping documents. Refer to Table 2 in the Product Description chapter for Remote IPE components part numbers and their description.

2 Plan the superloop and fiber-optic link configuration based on the traffic requirements (blocking or non-blocking traffic) at the Remote IPE site. Refer to:

- "Engineering guidelines" on page 31,
- Table 1, "Superloop connection configurations," on page 13 to specified the number of superloops required, and
- Table 2, "Equipment required to link Meridian 1 to Remote IPE sites," on page 14 to select the appropriate Fiber Remote Multi-IPE Interface type based on the number of superloops and the fiber-optic cable type.

3 Install the NT8D04 Superloop Network card into a network card slot and connecting the internal superloop cables to the network I/O panel. To identify an empty network card slot, refer to:

- Table 7, "Meridian 1 modules supporting Superloop Network cards," on page 49,
- "Installing the Superloop Network card" on page 50 to install the card into its designated card slot, and
- "Installing cables between the Superloop Network card and the network I/O panel" on page 50 to install cables between J1 and J2 faceplate connectors and the network I/O panel.

4 Configure and install the Fiber Remote Multi-IPE Interface unit. Refer to:

- "Setting SI and S2 switches at the local site" on page 51 to set the dip-switches S1 and S2, to install the redundant optical connectors, if required, and to install the unit onto the wall or into the shelf and
- "Installing local superloop cables" on page 65 to connect the cables between the network I/O panel and the SUPERLOOP connectors on the Fiber Remote Multi-IPE Interface unit.

5 Install the system monitor, local MMI terminal, and fiber-optic link cables to the Fiber Remote Multi-IPE Interface unit connectors. Refer to:

- "Connecting local system monitor cables" on page 65,
- "Connecting the SDI card and the MMI terminal to multiple Fiber Remote Multi-IPE Interface units" on page 70, and
- "Connecting the fiber-optic link" on page 72.

6 At the remote site, install the Remote IPE equipment. Refer to:

- "Installing the internal cables to the Remote IPE module" on page 80 and
- "Setting S1 and S2 switches at the remote site" on page 81.

7 Install the external cables to the I/O panel. Refer to:

- "Installing superloop cables" on page 86,
- "Connecting the system monitor cable" on page 87,
- "Connecting the MMI terminal" on page 88, and
- "Connecting the fiber-optic link to the Remote IPE Module" on page 90

8 Configure the Remote IPE local and remote sites. Refer to:

- "Configuring the cards" on page 94,
- "Selecting the MMI terminal modes" on page 98,
- "Configuring the MMI modem" on page 101, and
- "Configuring the Fiber Remote Multi-IPE Interface" on page 104

9 Conduct system acceptance testing. Refer to "Remote IPE acceptance testing" chapter in this manual.

Installation overview

The Remote IPE service over a fiber-optic link can be added to existing Meridian 1 system Options 51C, 61C, and 81C originally installed and operating without Remote IPE, or it can be an integral part of a newly installed Meridian 1 system.

To install a new Meridian 1 system or expand an existing one, refer to *Meridian 1 system installation procedures (553-3001-210).* It provides the information on how to install, verify, and maintain the Meridian 1 system.

Adding one or more Remote IPE sites to a Meridian 1 system is treated as a straightforward system expansion, that is, the system should be fully operational before the Remote IPE equipment is installed and connected to Meridian 1. This simplifies installation and fault isolation during installation. To complete the installation of a Remote IPE site, you should perform the preinstallation procedures to prepare the site, install the Fiber Remote Multi-IPE Interface, the fiber-optic link, and install the copper cables between the Fiber Remote Multi-IPE Interface units and Meridian 1 and between remote Fiber Remote Multi-IPE Interface units and the Remote IPEs.

Preinstallation procedures include:

— Preparing the site

— Unpacking and inspecting and taking inventory of the equipment

— Routing and splicing fiber-optic cables to create a fiber-optic link between two sites, if it does not already exist

— Connecting the fiber-optic link to the Fiber Remote Multi-IPE Interface at the Meridian 1 site and the Remote IPE site

— Selecting the Meridian I Superloop Network cards for connection to the Fiber Remote Multi-IPE Interface

Installation procedures include:

— Installing the Superloop Network cards in the selected network card slot, if not already installed

— Installing the cables between the J1 and J2 faceplate connectors on the Superloop Network cards and the network I/O panel connectors at the rear of the network module

— Installing the cables between the SL0 through SL3 backplane connectors on the Remote IPE module and the I/O panel connectors at the rear of the module

— Configuring the Fiber Remote Multi-IPE Interface dip-switches and installing the Fiber Remote Multi-IPE Interface unit onto the wall or in the shelf

— Connecting the fiber-optic link to the Fiber Remote Multi-IPE Interface fiber-optic ST-type connectors

— Connecting the external copper cables between the Fiber Remote Multi-IPE Interface unit and Meridian 1 network I/O panel connectors

— Connecting the master system monitor and MMI terminal cables at the local site

— Connecting the external copper cables between the Fiber Remote Multi-IPE Interface unit and the Remote IPE module I/O panel connectors

— Connecting the slave system monitor and MMI terminal cables at the remote site

— Connecting the fiber-optic link to the Fiber Remote Multi-IPE Interface at the Remote IPE site

Preinstallation preparation

Preinstallation preparation consists of preparing the site, unpacking and inspecting components, taking inventory, installing or selecting already installed Superloop Network cards which will support Remote IPE sites, installing the fiber-optic link, and preparing the Remote IPE column for connection to the Fiber Remote Multi-IPE Interface.

Preparing the site

When preparing a site, you must address environmental, structural, and electrical factors. These factors must be considered for the entire system, that is, Meridian 1 and Remote IPE sites. This information is available in:

— *Meridian 1 installation planning (553-3001-120)*

— *Meridian 1 system engineering (553-3001-151)*

— *Meridian 1 power engineering (553-3001-152)*

To prepare the site for Fiber Remote Multi-IPE Interface installation, you must first:

1 Install and verify the operation of Meridian 1 without linking Meridian 1 to the Remote IPE site(s). Refer to *Meridian 1 system installation procedures (553-3001-210)*.

2 Install the Remote IPE column at the remote site, if not already installed. Also refer to *Meridian 1 system installation procedures (553-3001-210)*.

3 Route and splice the fiber-optic cable between the Meridian 1 site and Remote IPE site(s).

Unpacking and inspection

Unpack and inspect the equipment for damage. When unpacking, follow general precautions recommended by computer and telephone equipment manufacturers:

— Remove items that generate static charge from the installation site.

— Use antistatic spray if the site is carpeted.

— Ground yourself before handling any equipment.

— Remove equipment carefully from its packaging.

— Visually inspect the equipment for obvious faults or damage. Any damaged component must be reported to your sales representative and the carrier who delivered the equipment.

— Do not bend and twist the fiber-optic cables excessively. Make sure that the cable is not bent beyond the specified minimum bending radius of 1.4 inches (3.5 cm) when handled or installed.

Taking inventory

After the equipment has been unpacked and visually inspected, verify that all the equipment is at the site before the installation begins. Equipment received must be checked against the shipping documents. Any shortages must be noted and reported to your sales representative.

Installing the fiber-optic link

If the fiber-optic link already exists, check its fiber-optic link characteristics and the end-to-end loss to determine if the link can support a Fiber Remote Multi-IPE Interface units and, if it can, at what distance between Meridian 1 and the Remote IPE.

Consult your Nortel Networks distributor to learn how to verify that the existing fiber-optic link is suitable for the Fiber Remote IPE application and what equipment to use to do so.

To connect the fiber-optic link to the Fiber Remote Multi-IPE Interface ST optical connectors at Meridian 1 (local) site and the Remote IPE (remote) site, the link fibers must be terminated with ST-type optical connectors.

CAUTION

If you are changing a fiber-optic system to the Fiber Remote Multi-IPE Interface, make sure that you change the fiber-optic link connectors to the appropriate ST-type. The ST-type optical connector must correspond to the type of fibers used in the fiber-optic link i.e. (single-mode or multi-mode). You may also use a fiber-optic adapter cable to adapt the existing connector type to the ST- type if the total link attenuation, including the adapter, does not exceed the maximum acceptable link loss.

Keep the optical connectors absolutely clean. Use pure isopropyl alcohol-treated lint-free wipes to clean the ferrule part of the optical connector and an aerosol duster to blow out dust particles from the adapter part of the optical connector.

Make sure that the ferrules in the optical connectors are properly installed and aligned in their respective adapters. This is particularly critical for the single-mode fibers where tolerances are tighter.

When routing the fiber-optic cables to the Fiber Remote Multi-IPE Interface units, take the following precautions:

— Do not bend the fiber-optic cable or individual fibers beyond the minimum bending radius specified by the cable manufacturer.

— Protect the exposed parts of the cable and fibers with plastic conduit.

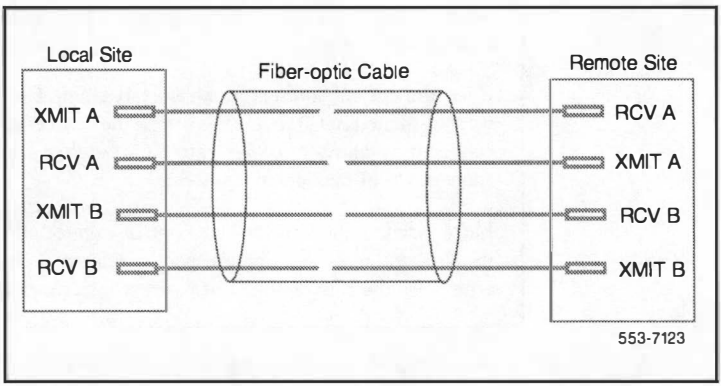
— Terminate each selected fiber with an ST optical connector (a fiber-optic cable may contain more fibers than required by the single or redundant link design). At the fiber management frame, the type of optical connectors used depends on the available frame optical connectors.

— Label optical fibers with XMIT A (transmit) and RCV A (receive) designator behind the ST optical connector for the primary link and XMIT B and RCV B for the redundant link to identify the function of each fiber in the link

Handle fibers with extreme care. Observe a minimum bending radius at all times. Optical connections to the optical units should be finger-tightened only.

The link fiber labeled XMIT A at the remote site must be labeled RCV A at the local site, and the link fiber labeled RCV A at the remote site must be labeled XMIT A at the local site. For a redundant link, label XMIT B at the remote site as RCV B at the local site, and RCV B at the remote site as XMIT B at the local site as shown in Figure 6.

Figure 6
Fiber-optic link



Selecting the Superloop Network card slot

To install the Superloop Network card that supports the Remote IPE application, you must first determine its card slot. The position of the Superloop Network card in Meridian 1 depends on the Meridian 1 system option installed at the local site. The system option determines in what type of module the card will be housed.

Table 7 lists modules that provide network card slots, system options where these modules are used, and card slots where Superloop Network cards can be installed.

Table 7
Meridian 1 modules supporting Superloop Network cards

Modules	System option	Network card slot
NT5D21 Core/Network Module	51C, 61C, 81C	0-7

Meridian 1 and fiber-optic equipment installation

To complete the installation of the Fiber Remote Multi-IPE Interface that links Meridian 1 to the Remote IPE equipment, you must:

— Install and verify the operation of the Meridian 1 system, if it is not already installed and operating correctly.

— Identify the network card slots and install the Superloop Network cards in these Meridian 1 network card slots, if these cards are not already installed.

— Install the Fiber Remote Multi-IPE Interface units.

— Connect the Fiber Remote Multi-IPE Interface units to the Meridian 1 I/O panel connectors.

— Connect the fiber-optic link to the Fiber Remote Multi-IPE Interface faceplate ST optical connectors.

Installing and verifying Meridian 1 operation

The Remote IPE facilities can be added to an existing Meridian 1 system by installing the appropriate electro-optical equipment in the link, installing one or more Remote IPE sites, and linking Meridian 1 with remote sites using single or redundant fiber-optic links.

To install a new Meridian 1 system, follow the instructions in *Meridian 1 system installation procedures (553-3001-210)*. It describes how to install a complete Meridian 1 system and how to connect the power, the internal and external communication cables, and subscriber loops.

If a new Meridian 1 system is configured with Remote IPE facilities, the system will normally be assembled at the factory with cards already installed including the Superloop Network cards selected to support the Remote IPE sites over a fiber-optic link. All you would have to do is to connect the Fiber Remote Multi-IPE Interface to the Meridian 1 and the Remote IPE and connect the fiber-optic link between the local and remote Fiber Remote Multi-IPE Interface units. However, if the Superloop Network card is not installed, install it now.

Installing the Superloop Network card

The purpose of the following steps is to instruct you how and where to install the Superloop Network card(s). In a new Meridian 1 system, the cards would have been installed in network card slots at the factory; however, you may have to install additional Superloop Network cards to expand the number of remote sites or replace a defective card.

To install these cards:

1 Set the ENB/DIS switch on the Superloop Network card to DIS.

2 Pull the Superloop Network card's upper and lower locking device away from the faceplate. While holding the card by these locking devices, insert it into the card guides of the selected network card slot.

3 Slide the card into the module until it engages the backplane connector.

4 Carefully push the upper and lower locking device levers towards the faceplate to insert the card connector into the backplane connector and lock the card in place.

5 Set the ENB/DIS switch on the Superloop Network card to ENB and observe the LED on the card as it performs self-tests. The LED should blink three times and then stay ON until enabled by software. When enabled by software, the LED turns OFF permanently, if operational.

Installing cables between the Superloop Network card and the network I/O panel

To connect Meridian 1 superloops to the Fiber Remote Multi-IPE Interface and the fiber-optic span, you must first install the internal cables connecting J1 and J2 Superloop Network card faceplate connectors to the network I/O panel.

In a new Meridian 1 system with Remote IPE, these cables are normally installed in the factory, however, for an existing Meridian 1 system that is being expanded using the Remote IPE, these cables must be installed at the site. To do this:

1 Remove the back cover from the network module where the Superloop Network cards are installed.

2 Plug the 24-pin connector of the NT8D88AD cable into the Superloop Network card J1 or J2 faceplate connector.

Note: To determine which faceplate connectors to use and how many superloops are required for your specific application, consult Table 1 "Superloop connection configurations" on page 13.

3 Route the cable to the back of the module to the network I/O panel.

4 Install the 24-pin Centronics NT8D88AD cable connector into the network module I/O panel connector cutouts. Use longer screws supplied in the kit with the cable assembly.

5 Repeat steps 2 through 4 for each superloop connection required in your application.

6 To install the internal cables between the Superloop Network card in an NT or XT system shelf and the I/O connector housing at the top of the cabinet:

- Plug the 24-pin connector of the NT8D88AD cable into the Superloop Network card J1 or J2 faceplate connector.
- Route the other end of the cable to the top of the cabinet.
- Install the 24-pin Centronics NT8D88AD cable connector into the I/O connector housing cutouts at the top of the cabinet. Use extender cable if the NT8D88AD cable is too short.
- Repeat the above three steps for each internal superloop cable.

Setting S1 and S2 switches at the local site

Before you can install a Fiber Remote Multi-IPE Interface unit, you must:

— Configure the Fiber Remote Multi-IPE Interface using S1 and S2 dip-switches

— Install redundant fiber-optic connectors, if required

Table 8 lists functions controlled by dip-switches S1 and S2. It also shows how to set these switched to configure the Fiber Remote Multi-IPE Interface.

Table 8
Fiber Remote Multi-IPE Interface configuration

Function Selection	Switch and Position	Switch Setting
For **single** Fiber Remote Multi-IPE Interface unit	S1 Position 1 and Position 2	ON (at local and remote sites)
Fiber Remote Multi-IPE Interface at the **MMI terminal or modem end** of the daisy-chain	S1 Position 1 Position 2	ON OFF
Fiber Remote Multi-IPE Interface at the **SDI port end** of the daisy-chain	S1 Position 1 Position 2	OFF ON
Fiber Remote Multi-IPE Interface in the **middle of the daisy-chain**	S1 Position 1 Position 2	OFF OFF
Fiber Remote Multi-IPE Interface **address in a daisy-chain** and **system monitor address**	S1 Positions 3-8	Refer to Table 9
Physical location of the Fiber Remote Multi-IPE Interface	S2 Position 1	ON-Remote site OFF-Local site
Reserved for future use	S2 Positions 3-8	OFF

Note: Switch position: **ON= Down** and **OFF= Up** for S1 and S2 switches.

Table 9 lists the available addresses for each Fiber Remote Multi-IPE Interface unit in a daisy-chain and the system monitor address. Each Fiber Remote Multi-IPE Interface must have a unique address from 0 to 63.

Table 9
Fiber Remote Multi-IPE Interface and system monitor address selection table (Part 1 of 3)

Address	S1 Pos 3	S1 Pos 4	S1 Pos 5	S1 Pos 6	S1 Pos 7	S1 Pos 8
00	OFF	OFF	OFF	OFF	OFF	OFF
01	ON	OFF	OFF	OFF	OFF	OFF
02	OFF	ON	OFF	OFF	OFF	OFF
03	ON	ON	OFF	OFF	OFF	OFF
04	OFF	OFF	ON	OFF	OFF	OFF
05	ON	OFF	ON	OFF	OFF	OFF
06	OFF	ON	ON	OFF	OFF	OFF
07	ON	ON	ON	OFF	OFF	OFF
08	OFF	OFF	OFF	ON	OFF	OFF
09	ON	OFF	OFF	ON	OFF	OFF
10	OFF	ON	OFF	ON	OFF	OFF
11	ON	ON	OFF	ON	OFF	OFF
12	OFF	OFF	ON	ON	OFF	OFF
13	ON	OFF	ON	ON	OFF	OFF
14	OFF	ON	ON	ON	OFF	OFF
15	ON	ON	ON	ON	OFF	OFF
16	OFF	OFF	OFF	OFF	ON	OFF
17	ON	OFF	OFF	OFF	ON	OFF
18	OFF	ON	OFF	OFF	ON	OFF
19	ON	ON	OFF	OFF	ON	OFF
20	OFF	OFF	ON	OFF	ON	OFF
21	ON	OFF	ON	OFF	ON	OFF
22	OFF	ON	ON	OFF	ON	OFF
23	ON	ON	ON	OFF	ON	OFF
24	OFF	OFF	OFF	ON	ON	OFF

Table 9
Fiber Remote Multi-IPE Interface and system monitor address selection table (Part 2 of 3)

Address	S1 Pos 3	S1 Pos 4	S1 Pos 5	S1 Pos 6	S1 Pos 7	S1 Pos 8
25	ON	OFF	OFF	ON	ON	OFF
26	OFF	ON	OFF	ON	ON	OFF
27	ON	ON	OFF	ON	ON	OFF
28	OFF	OFF	ON	ON	ON	OFF
29	ON	OFF	ON	ON	ON	OFF
30	OFF	ON	ON	ON	ON	OFF
31	ON	ON	ON	ON	ON	OFF
32	OFF	OFF	OFF	OFF	OFF	ON
33	ON	OFF	OFF	OFF	OFF	ON
34	OFF	ON	OFF	OFF	OFF	ON
35	ON	ON	OFF	OFF	OFF	ON
36	OFF	OFF	ON	OFF	OFF	ON
37	ON	OFF	ON	OFF	OFF	ON
38	OFF	ON	ON	OFF	OFF	ON
39	ON	ON	ON	OFF	OFF	ON
40	OFF	OFF	OFF	ON	OFF	ON
41	ON	OFF	OFF	ON	OFF	ON
42	OFF	ON	OFF	ON	OFF	ON
43	ON	ON	OFF	ON	OFF	ON
44	OFF	OFF	ON	ON	OFF	ON
45	ON	OFF	ON	ON	OFF	ON
46	OFF	ON	ON	ON	OFF	ON
47	ON	ON	ON	ON	OFF	ON
48	OFF	OFF	OFF	OFF	ON	ON
49	ON	OFF	OFF	OFF	ON	ON
50	OFF	ON	OFF	OFF	ON	ON
51	ON	ON	OFF	OFF	ON	ON
52	OFF	OFF	ON	OFF	ON	ON

Table 9
Fiber Remote Multi-IPE Interface and system monitor address selection table (Part 3 of 3)

Address	S1 Pos 3	S1 Pos 4	S1 Pos 5	S1 Pos 6	S1 Pos 7	S1 Pos 8
53	ON	OFF	ON	OFF	ON	ON
54	OFF	ON	ON	OFF	ON	ON
55	ON	ON	ON	OFF	ON	ON
56	OFF	OFF	OFF	ON	ON	ON
57	ON	OFF	OFF	ON	ON	ON
58	OFF	ON	OFF	ON	ON	ON
59	ON	ON	OFF	ON	ON	ON
60	OFF	OFF	ON	ON	ON	ON
61	ON	OFF	ON	ON	ON	ON
62	OFF	ON	ON	ON	ON	ON
63	ON	ON	ON	ON	ON	ON

Setting the S1 dip-switch

Dip-switch S1 defines the connection of the Fiber Remote Multi-IPE Interface to the MMI terminal, the SDI port, and the daisy-chain address of each Fiber Remote Multi-IPE Interface unit. Refer to Figure 11 "Daisy-chaining of multiple Fiber Remote Multi-IPE Interface units" on page 72. It also defines the system monitor address at the remote site.

To configure the S1 dip-switch, refer to Figure 7 and follow the steps below:

1 Eject the motherboard from the metal enclosure by pushing the ejector tabs outward away from the Fiber Remote Multi-IPE Interface faceplate.

2 Configure the Fiber Remote Multi-IPE Interface using S1 dip-switch, refer to Table 8 and Table 9 for instructions.

- **For a single unit**. If Fiber Remote Multi-IPE Interface units are not daisy-chained, set dip-switch S1 positions 1 and 2 to ON.
- **First unit in the chain**. For the first Fiber Remote Multi-IPE Interface in the daisy-chain the SDI connector connects to the MAINT connector of the following Fiber Remote Multi-IPE Interface and its MAINT connector connects to the MMI terminal through the A0656212 MMI Adapter. For the first Fiber Remote Multi-IPE Interface in the daisy-chain must be set dip-switch S1 position 1 to ON and position 2 to OFF, as shown in Table 8.
- **Unit in the middle of the chain**. For Fiber Remote Multi-IPE Interface units in the middle of the daisy-chain, dip-switch S1 positions 1 and 2 must be set to OFF.
- **Last unit in a daisy-chain**. For the Fiber Remote Multi-IPE Interface at the end of the daisy-chain, where it connects the SDI connector to the SDI port in Meridian 1 and the MAINT connector to the SDI connector on the next Fiber Remote Multi-IPE Interface in the daisy-chain. For the last Fiber Remote Multi-IPE Interface in the daisy-chain that connects to the SDI port, dip-switch S1 position 1 must be set to OFF and position 2 must be set to ON, as shown in Table 8.

Note: To assign a unique address to each Fiber Remote Multi-IPE Interface in a daisy-chain at the local site, set S1 positions 3-8 as shown in Table 9. At the Remote IPE site, use this table to assign a unique system monitor address of the Fiber Remote Multi-IPE Interface, which is connected to the system monitor card in the pedestal of the Remote IPE column. The system monitor address must be the same as the address of the Fiber Remote Multi-IPE Interface connected to the system monitor card in the pedestal.

Setting the S2 dip-switch

Dip-switch S2 defines the physical location of the Fiber Remote Multi-IPE Interface unit in the fiber-optic link.

To specify the physical location of the Fiber Remote Multi-IPE Interface units:

1 For the local Fiber Remote Multi-IPE Interface units, set dip-switch S2 position 1 to OFF.

2 For the remote Fiber Remote Multi-IPE Interface units, set dip-switch S2 position 1 to ON, as shown in Table 8.

Installing redundant fiber-optic link option

The redundant fiber-optic link is optional. Unless your system configuration requires a redundant fiber-optic link, you do not have to install the following hardware.

To install the redundant fiber-optic link connectors, you must install the daughterboard that corresponds to the type of fiber used in the link. Refer to Figure 7 for installation details.

The daughterboard types are:

— A0634492 Redundant Option for single-mode fiber

— A0634493 Redundant Option for multi-mode fiber

To install the daughterboard:

1 Remove the two filler plugs on the Fiber Remote Multi-IPE Interface faceplate labeled XMIT B and RCV B.

Note: The Fiber Remote Multi-IPE Interface mother board has already been exposed during switch setting procedure.

2 Locate four screw holes near the top left-hand corner of the motherboard.

3 Insert the fiber-optic ST-type connectors into the openings on the faceplate and install the daughterboard onto the four standoffs. Tighten the four screws into the standoffs to secure the daughterboard.

4 Hand tighten the nuts onto the ST connectors. Do not overtighten.

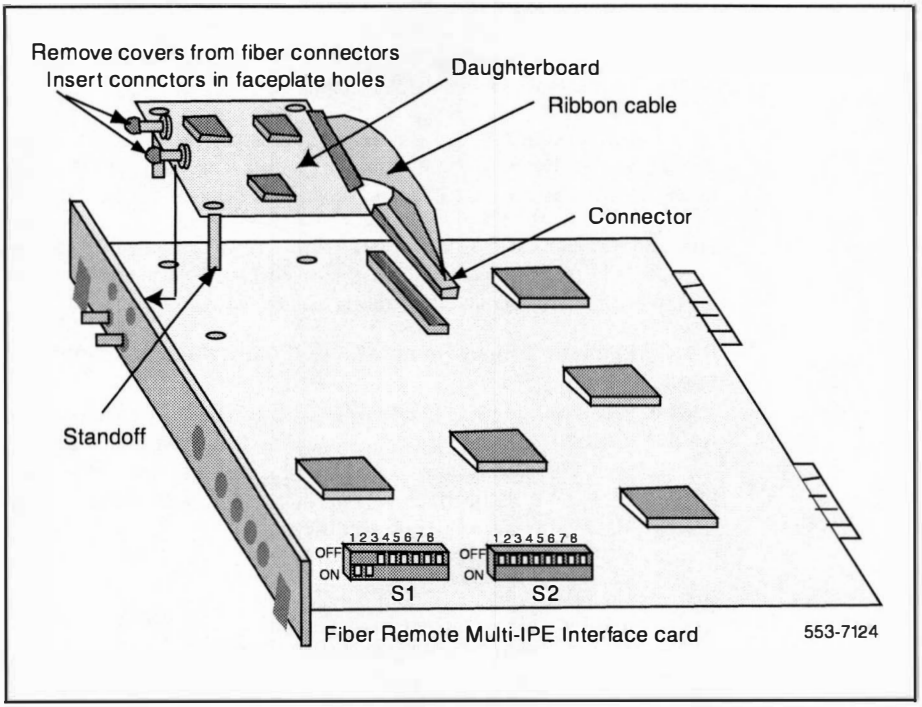
5 Plug the ribbon cable from the daughterboard to the connector on the motherboard.

6 Close the Fiber Remote Multi-IPE Interface unit by pushing faceplate in until is flush with the front of the enclosure and no slack is in the ejector tabs.

7 Install the Fiber Remote Multi-IPE Interface unit into the rack-mounted shelf or onto the wall, as shown in Figure 8 and Figure 9.

Figure 7 shows the installation of the daughterboard onto the motherboard of the Fiber Remote Multi-IPE Interface unit.

Figure 7
Installing the redundant fiber-optic link option



Mounting the Fiber Remote Multi-IPE Interface units

The Fiber Remote Multi-IPE Interface unit can be installed onto a wall or into a rack-mounted shelf that accommodates up to six Fiber Remote Multi-IPE Interface units. These units must be install within 30 feet from the Meridian 1 and the Remote IPE, because the cables connecting the Fiber Remote Multi-IPE Interface units to the Meridian 1 equipment are 30 feet long. The power cable between the Fiber Remote Multi-IPE Interface unit and its AC/DC Power Converter is only 25 feet long.

Two slotted holes are provided at the back of the enclosure to mount the Fiber Remote Multi-IPE Interface unit on the wall such that the faceplate is located on the left-hand-side and the I/O panel at the right-hand-side of the unit.

For multiple Fiber Remote Multi-IPE Interface units, a rack-mounted shelf is provided to house up to six units. This is normally used at the local site, where the possibility of having multiple units is much greater.

Installing multiple Fiber Remote Multi-IPE Interface units into the shelf

The Fiber Remote Multi-IPE Interface units can also be installed into the A0634494 Rack Mounted Shelf. This is practical if you have multiple Fiber Remote Multi-IPE Interface units at the local site. The shelf supports up to six Fiber Remote Multi-IPE Interface units and mounts onto a 19-inch rack using standard 10x32 pan head screws. Refer to Figure 8 for installation illustration.

To install the shelf and the units into the shelf:

1 Place the shelf onto a 19-inch rack and use 10x32 pan screws (not included with the shelf) to secure the shelf in place.

Note: If a solid panel is positioned above the shelf, make sure that there is at least four inches of empty space above the shelf. However, if the panel or shelf above has at least 50% airflow capacity, no empty space above the shelf is required.

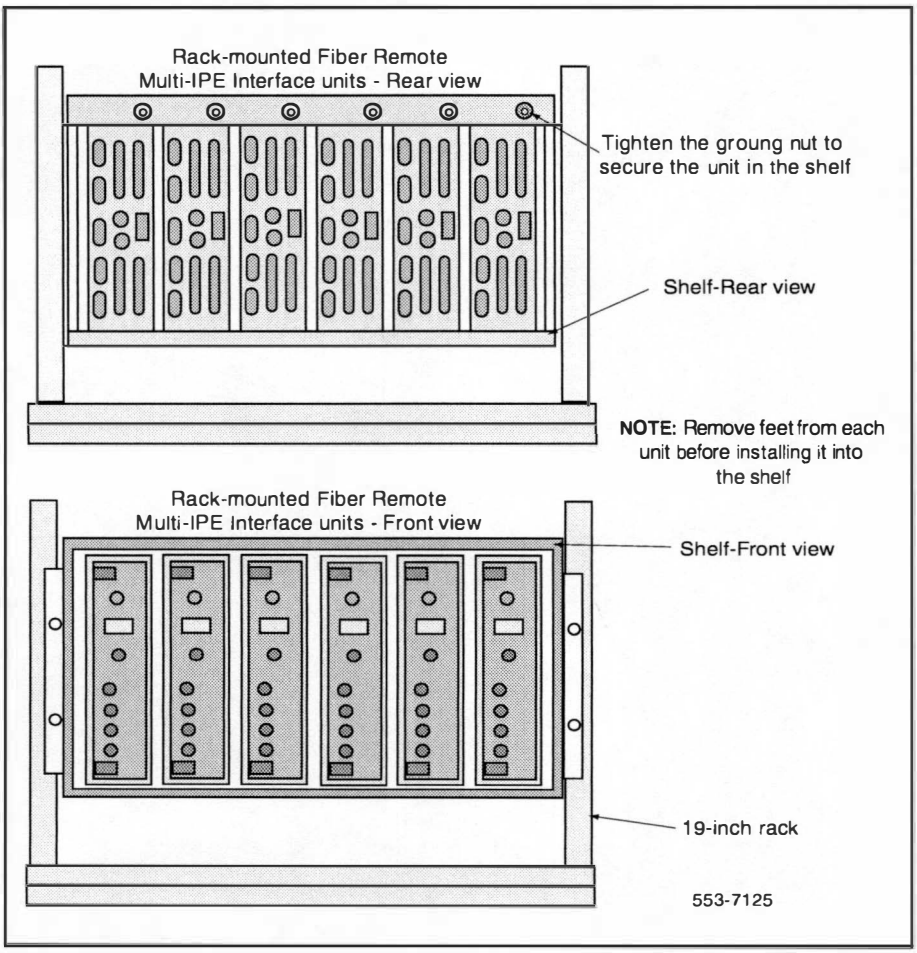
2 Install the Fiber Remote Multi-IPE Interface units into the shelf slots by sliding them in from the front of the shelf.

3 Allow adequate space in front and the back of the shelf to be able to install the fiber-optic links in the front and the superloop cables in the back.

Note: When installing the fiber-optic cables, make sure that the minimum bending radius does not exceed cable manufacturer's specification. If the bending radius is smaller than recommended, the fiber may be damaged.

Figure 8 illustrates the installation of the Fiber Remote Multi-IPE Interface units on the wall and into a rack-mounted shelf.

Figure 8
The Fiber Remote Multi-IPE Interface unit installation methods



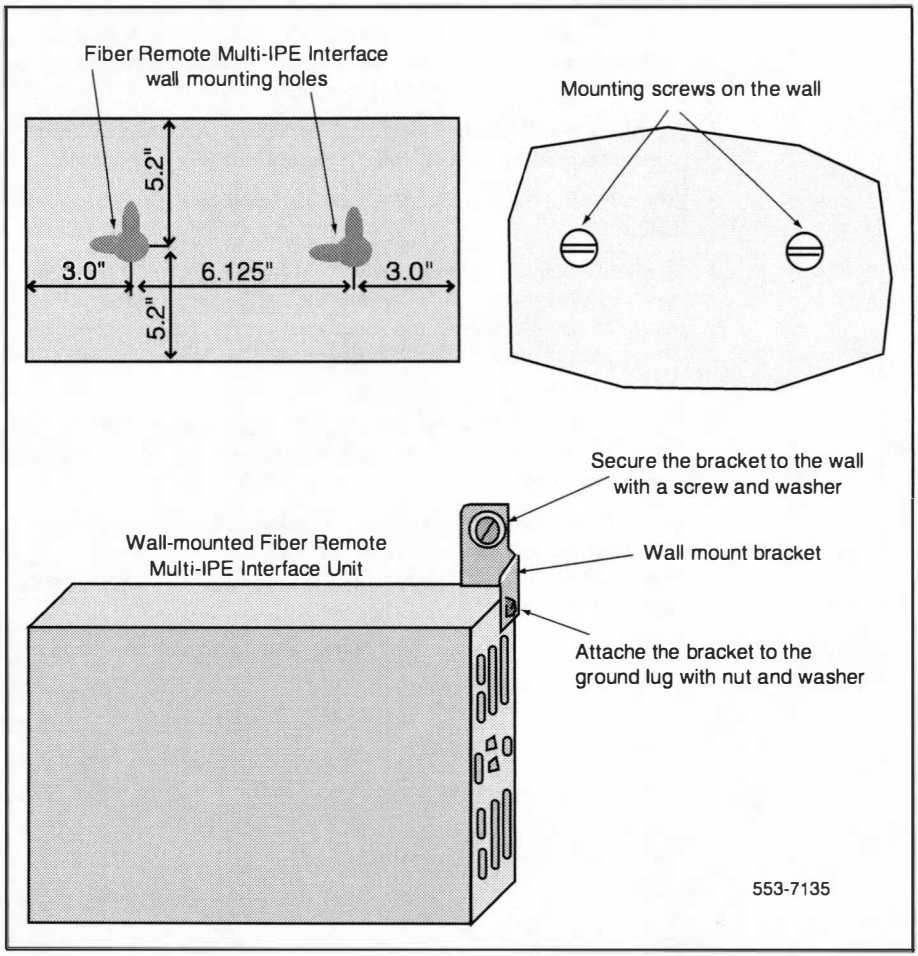
Installing the Fiber Remote Multi-IPE Interface unit onto the wall

To mount the Fiber Remote Multi-IPE Interface unit on the wall refer to Figure 9 and follow these steps:

1. Find a location on the wall to give the Fiber Remote Multi-IPE Interface unit enough clearance to install the fiber-optic cables in the front and superloop cables in the back of the unit. Allow for a minimum of six inches of clearance in the front for the fiber-optic cables. Provide a minimum of 13 inches of clearance in the front.
2. Position the wall mount template on the wall and use a level to ensure horizontal positioning of the Fiber Remote Multi-IPE Interface unit.
3. Mark the three screw holes and the two alignment marks. Drill the screw holes.
4. Screw two number 8 screws into the wall board or plywood. The screw heads should be 1/16 inch away from the wall surface to allow you to insert the screw heads into the slotted holes on the bottom of the Fiber Remote Multi-IPE Interface unit. Refer to Figure 8 to see the hole location templet.
5. Place the wall mount bracket in the upper rear corner of the Fiber Remote Multi-IPE Interface unit and fasten it to the Ground lug with the attached nut and lock washer.
6. Position the Fiber Remote Multi-IPE Interface unit's holes over the two screws on the wall, insert the screws into the holes, and push the Fiber Remote Multi-IPE Interface unit to the left to engage the screws into the narrow of the slots.
7. Fasten the top of the wall mount bracket to the wall with the provided screw.

Figure 9 illustrates the installation of the Fiber Remote Multi-IPE Interface unit onto the wall.

Figure 9
Wall-mounting the Fiber Remote Multi-IPE Interface unit



Installing local superloop cables

The number of A0634495 Local Superloop cables required to connect the network I/O panel 24-pin Centronics connectors to the 37-pin D Shell SUPERLOOP connectors on the Fiber Remote Multi-IPE Interface I/O panel depends on the number of superloops required to support the Remote IPE site(s) configuration. Refer to Appendix, Figure 15 for the connection diagram.

> ***Note:*** Use the superloop connection plan that you completed based on the traffic blocking criteria for Remote IPE segments and Table 1 "Superloop connection configurations" on page 13.

To install these cables:

1. Locate all the superloop connectors on the network I/O panel designated to support Remote IPE sites over the fiber-optic link.
2. Verify that you have configured and installed the appropriate version of the Fiber Remote Multi-IPE Interface unit (number of superloops and type of fiber supported). Refer to Table 2 "Equipment required to link Meridian 1 to Remote IPE sites" on page 14.
3. Plug the 24-pin Centronics A0634495 Local Superloop cable connector into the designated 24-pin I/O panel connector in Meridian 1. Fasten balelocks.
4. Plug the 37-pin D Shell connector into the appropriate SUPERLOOP connector on the Fiber Remote Multi-IPE Interface unit I/O panel. Tighten screws.
5. Repeat steps 3 and 4 for each superloop you have to connect.

Connecting local system monitor cables

The Fiber Remote Multi-IPE Interface unit can be directly connected to a system monitor, or it can be daisy-chained with multiple Fiber Remote Multi-IPE Interface units and only one unit in the daisy-chain is directly connected to the system monitor card in the pedestal. Refer to Appendix, Figure 15 for the connection diagram.

Connecting a single Fiber Remote Multi-IPE Interface to the system monitor

To connect the system monitor cable from the Fiber Remote Multi-IPE Interface unit to the system monitor at the Meridian 1 local site:

1 Plug one end of the NT8D46AP cable 6-pin modular plug into the J6 jack of the system monitor in the pedestal. This system monitor can be the master or an upstream system monitor towards the master system monitor.

2 Plug the other end of the NT8D46AP cable 6-pin modular plug into the XSM IN (J5) modular jack on the Fiber Remote Multi-IPE Interface unit.

Connecting multiple Fiber Remote Multi-IPE Interface units to the system monitor

To daisy-chain the system monitor cables to multiple Fiber Remote Multi-IPE Interface units, refer to Figure 10 and perform these steps:

1 Plug the one end of the NT8D46AP cable 6-pin modular plug into the 6-pin modular jack J6 on the system monitor card in the Meridian 1 pedestal.

2 Plug the other end of the NT8D46AP cable 6-pin modular plug into the first Fiber Remote Multi-IPE Interface unit 6-pin modular jack XSM IN (J5).

3 Plug one end of the NT8D46AL (or an equivalent cable) cable 6-pin modular plug into the first Fiber Remote Multi-IPE Interface unit 6-pin modular jack XSM OUT (J6).

4 Plug the other end of the NT8D46AL cable 6-pin modular plug into the second Fiber Remote Multi-IPE Interface unit 6-pin modular jack XSM IN (J5).

5 Plug one end of the NT8D46AL cable 6-pin modular plug into the second Fiber Remote Multi-IPE Interface unit 6-pin modular jack XSM OUT (J6).

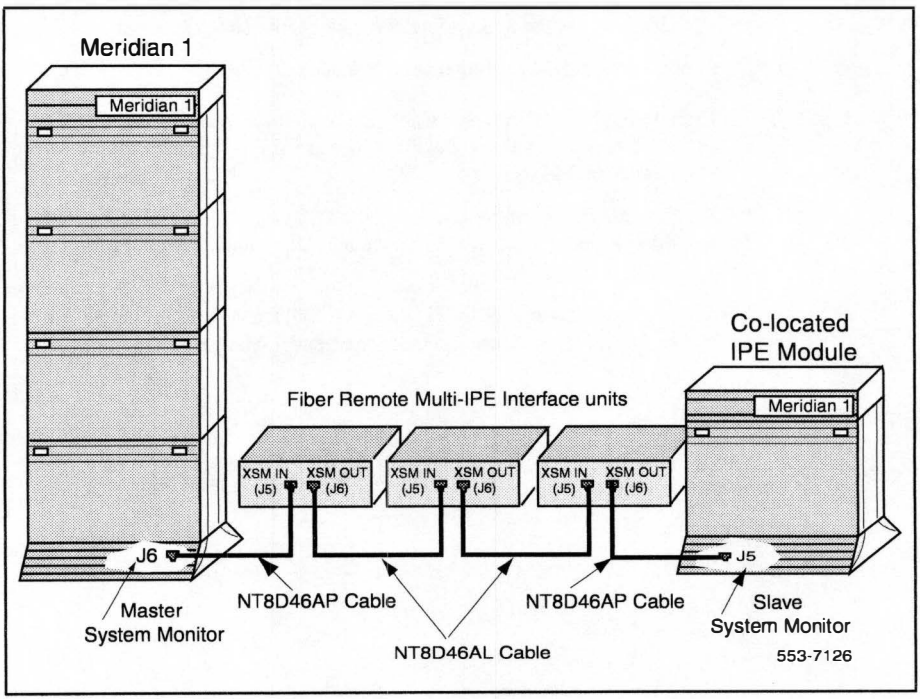
6 Plug the other end of the NT8D46AL cable 6-pin modular plug into the third Fiber Remote Multi-IPE Interface unit 6-pin modular jack XSM IN (J5).

7 Repeat steps 5 and 6 for any additional Fiber Remote Multi-IPE Interface unit.

8 The XSM OUT (J6) in the last Fiber Remote Multi-IPE Interface unit in the daisy-chain connects to the J5 of the slave system monitor in the co-located IPE Module when this system monitor is outbound from the last Fiber Remote Multi-IPE Interface unit in the chain, as shown in Figure 10.

Figure 10 illustrates the daisy-chaining of the system monitor connections for multiple Fiber Remote Multi-IPE Interface units at the local site.

Figure 10
System monitor daisy-chain connections at the local Meridian 1 site



Connecting the MMI terminal to a single Fiber Remote Multi-IPE Interface unit

Refer to Appendix, Figure 15 for the connection diagram to connect the MMI terminal to the MAINT port and follow these steps:

1 To connect the MMI terminal to the Fiber Remote Multi-IPE Interface I/O panel MAINT DB-9 male connector, use the NT7R66BA MMI Cable.

2 Plug the NT7R66BA MMI Cable DB-9 female connector into the DB-9 male MAINT connector on the Fiber Remote Multi-IPE Interface unit.

3 Plug the DB-25 male connector end of the NT7R66BA MMI Cable into the MMI terminal RS-232 port. If you have to change the gender at the terminal, use the appropriate compact gender changer.

Connecting the MMI terminal using a modem:

1 Use the NT7R66AA SDI Cable Kit to connect the DB-9 female MODEM connector on the Fiber Remote Multi-IPE Interface unit to the modem connector.

2 Plug the DB-9 male connector of the NT7R66AA SDI Cable Kit into the Fiber Remote Multi-IPE Interface unit DB-9 female MODEM connector.

3 Plug the other end of the NT7R66AA SDI Cable Kit into the modem connector. Use the enclosed adapter gender changer, if required.

Connecting the SDI port to a single Fiber Remote Multi-IPE Interface unit

A single Fiber Remote Multi-IPE Interface unit can be connected directly to the SDI port in Meridian 1 over the SDI connector on a single Fiber Remote Multi-IPE Interface unit I/O panel. Refer to Appendix, Figure 15 for the connection diagram.

Connect a single Fiber Remote Multi-IPE Interface unit to the QPC841 or other SDI cards.

Connecting an NT8D41 SDI Paddleboard:

1 To connect NT8D41 SDI Paddleboard to the Fiber Remote Multi-IPE Interface SDI DB-9 male connector, use the NT8D93AJ XSDI I/O cable and NT7R66AA SDI Cable Kit, which consists of a 10-foot DB-9 male to DB-25 male cable and a DB-25F/DB-25F adapter.

2 Combine the cable and the adapter of the NT7R66AA SDI Cable Kit and tighten the retaining screws.

3 Plug the NT8D93AJ cable DB-9 male connector into the Paddleboard DB-9 female connector.

4 Plug the NT8D93AJ cable DB-25 male connector into the DB-25 female connector of the NT7R66AA SDI Cable Kit.

5 Plug the NT7R66AA SDI Cable Kit DB-9 male connector into the DB-9 female SDI connector on the Fiber Remote Multi-IPE Interface I/O panel.

Connecting any other SDI card:

1 To connect other SDI cards to the Fiber Remote Multi-IPE Interface SDI DB-9 male connector, use the NT7R66AA SDI Cable Kit without the DB-25F/DB-25F adapter.

2 Plug the DB-25 male connector of the NT7R66AA SDI Cable Kit into the DB-25 female SDI connector on the I/O panel.

3 Plug the DB-9 male connector of the NT7R66AA SDI Cable Kit into the DB-9 female connector on the Fiber Remote Multi-IPE Interface unit I/O panel.

Note: For additional information about types of SDI cards, their SDI ports, and special cables required to connect these ports, refer to *Meridian 1 serial data interface cards description (553-3001-107).*

Connecting the SDI card and the MMI terminal to multiple Fiber Remote Multi-IPE Interface units

Make sure that all the Fiber Remote Multi-IPE Interface unit are properly configured for the daisy-chain addressing as shown in Table 8 "Fiber Remote Multi-IPE Interface configuration" on page 52. Refer to Appendix, Figure 16 for the connection diagram.

Note: For maintenance convenience, use the daisy-chain addressing in descending order from the MMI terminal side to the host SDI side.

To connect multiple (this example has 3 units) Fiber Remote Multi-IPE Interface unit in a daisy-chain configuration, connect the cables as shown in Figure 11:

1 Plug the DB-9 male connector of the NT7R66AA SDI Cable Kit into the SDI port DB-9 female connector on the Fiber Remote Multi-IPE Interface unit #1.

2 Connect the Fiber Remote Multi-IPE Interface unit #1 to the SDI card in Meridian 1 as explained in "Connecting the SDI port to a single Fiber Remote Multi-IPE Interface unit" on page 69.

3 Plug the A0634497 Maintenance Interface cable into the DB-9 male MAINT connector on the Fiber Remote Multi-IPE Interface unit #1.

4 Plug the other end of the A0634497 Maintenance Interface cable into the DB-9 female SDI connector on the Fiber Remote Multi-IPE Interface unit #2.

5 Plug a second A0634497 Maintenance Interface cable into the MAINT connector on the Fiber Remote Multi-IPE Interface unit #2.

6 Plug the other end of the second A0634497 Maintenance Interface cable into the SDI connector on the Fiber Remote Multi-IPE Interface unit #3.

7 Plug the DB-9 female connector of the NT7R66BA MMI Cable into the MAINT port DB-9 male connector on the Fiber Remote Multi-IPE Interface unit #3 (last in the chain).

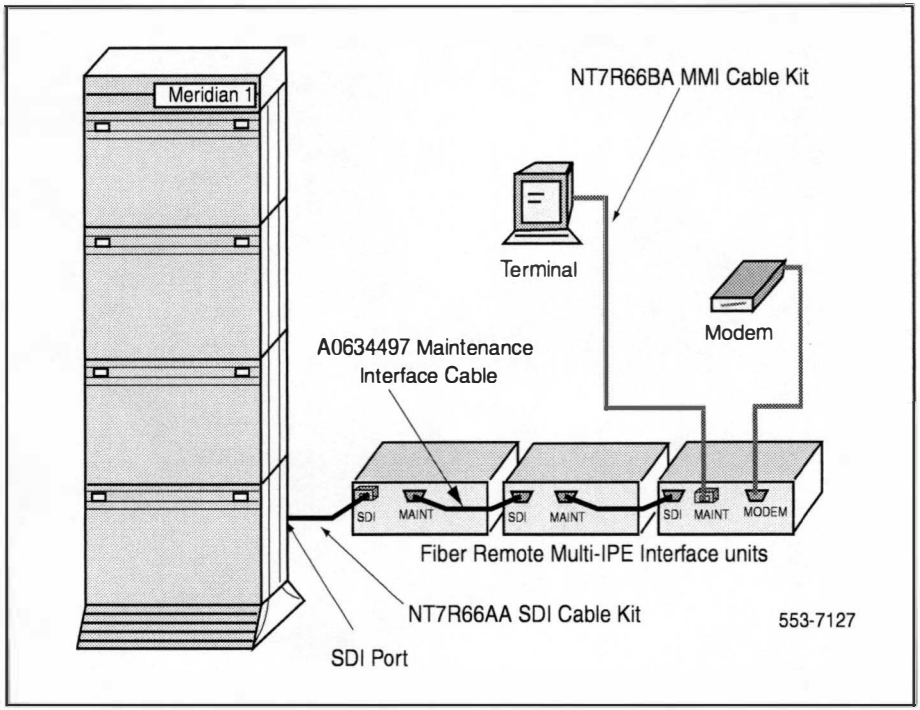
8 Plug the DB-25 male connector of the NT7R66BA MMI Cable into the MMI terminal RS-232 port. If the MMI terminal has other than DB-25 connector, use an appropriate compact adapter.

9 If you wish to connect a distant MMI terminal over a modem, connect the NT7R66AA SDI Cable Kit between the DB-9 female MODEM connector on the Fiber Remote Multi-IPE Interface unit #3 and the modem.

10 Secure cables with tie-wraps as appropriate.

Figure 11 shows how to connect multiple Fiber Remote Multi-IPE Interface units in a daisy-chain to provide MMI and SDI connections for all Fiber Remote Multi-IPE Interface units and through them to their respective Remote IPE sites.

Figure 11
Daisy-chaining of multiple Fiber Remote Multi-IPE Interface units



Connecting the fiber-optic link

The fiber-optic link connects the local Fiber Remote Multi-IPE Interface with the remote Fiber Remote Multi-IPE Interface. Each Fiber Remote Multi-IPE Interface unit provides a transmit and a receive optical connector for a non-redundant fiber-optic link or two transmit and two receive optical connectors for a redundant fiber-optic link.

The fiber-optic cable fibers, at each end of the link, must be terminated with ST optical connectors. Each connector plugs into the ST optical connector on the Fiber Remote Multi-IPE Interface faceplate. For details of how to engineer and handle the fiber-optic link and the fiber-optic connectors, refer to See "Engineering the fiber-optic link" on page 32.

For a single link, you need to install connectors on only two fibers at each end of the link, one for the transmit side and one for the receive side. For a redundant link, four fibers must have connectors installed at each end.

> ***Note:*** Label optical fibers in the fiber-optic cable next to the ST optical connectors. Label one fiber XMIT A and its pair RCV A at one end of the link. Label these two fibers at the other end of the link with opposite label, i. e. the XMIT A at one end should be labeled RCV A at the other end of the link and the RCV A at one end should be labeled XMIT A at the other end of the link. Repeat the same procedure for the redundant link with XMIT B and RCV B. For illustration of the link fibers labelling, refer to Figure 6 in the *Product description* section of this document.

To connect the link to the Fiber Remote Multi-IPE Interface at either side of the link, refer to Appendix, Figure 15 for the connection diagram and follow these steps:

1. Identify the link ST optical connectors labeled XMIT A and RCV A for a single link, or labeled XMIT A, RCV A, XMIT B, and RCV B for a redundant link.
2. Plug the link ST optical connector labeled XMIT A into the Fiber Remote Multi-IPE Interface faceplate ST optical connector labeled XMIT A.
3. Plug the link ST optical connector labeled RCV A into the Fiber Remote Multi-IPE Interface faceplate ST optical connector labeled RCV A.
4. Repeat steps 2 and 3 for the XMIT B and RCV B if you have a redundant link.
5. Route and secure the fiber-optic cable to prevent excessive bending and other physical damage.

Connecting the external alarm cable at the local site

The Fiber Remote Multi-IPE Interface unit provides an external alarm output connector (ALM), which is connected to external alarm indicators at the Meridian 1 local site. These alarm outputs indicate external alarm contact closures at the Remote IPE site and the failure of the fiber-optic link.

Use a cable with a DB-9 male connector at one end and open wires at the other end. The open-wire end can be customized with connector(s) to match your external alarm indicator devices. The length of the cable depends on the distance between the Fiber Remote Multi-IPE Interface unit and the external alarm devices.

Table 10 lists the Fiber Remote Multi-IPE Interface unit DB-9 female ALM connector pinouts for each external output alarm indicator.

Table 10
The DB-9 male ALM connector pinouts (local site)

External Alarm Output Contact Closure	Connector Pin
Output alarm #1 (activated by remote external alarm #1)	7
Output alarm #2 (activated by remote external alarm #2)	2
Output alarm #3 (activated by a fault in the fiber-optic link)	6
Output alarm return	1

To install the external alarm cable:

1 Plug the cable DB-9 male connector into the DB-9 female ALM connector on the Fiber Remote Multi-IPE Interface unit. This cable is not supplied.

2 Connect the other end of the cable to the external alarm indicator devices. Observe the wires color code as related to the pin assignment at the connector when wiring the external alarm devices to the cable.

Connecting the power source

A Fiber Remote Multi-IPE Interface unit can be powered by a either:

— DC system power source, or

— AC/DC Power Converter

Note: A DC system power source is fused with a 1.3 A fuse at the PDU.

Connecting the DC power source

If the Meridian 1 system is DC-powered or has a DC power backup, you can utilize this -48 V source instead of using the A0634498 AC/DC power converter.

To install the A0654976 DC Power Cable between the system -48 V DC power source and the power connector on the Fiber Remote Multi-IPE Interface unit refer to Figure 12 and the following steps:

1 Install lugs onto the open end of the A0654976 DC Power Cable suitable for the power terminals at the DC power source.

2 Connect the black wire at the open end of the A0654976 DC Power Cable to the -48V DC terminal on the Meridian 1 DC power system PDU.

3 Connect the red wire at the open end of the cable to the Return terminal on the Meridian 1 DC power system PDU.

4 Connect the white wire at the open end of the cable to the Ground terminal on the Meridian 1 DC power system Chassis Ground lug.

5 Plug the 4-pin connector at the other end of the A0654976 DC Power Cable into the power connector on the Fiber Remote Multi-IPE Interface unit located on the I/O panel at the rear of the unit.

6 Connect the white wire at the connector end of the A0654976 DC Power Cable to the Ground lug at the Fiber Remote Multi-IPE Interface unit I/O panel, as shown in Figure 12.

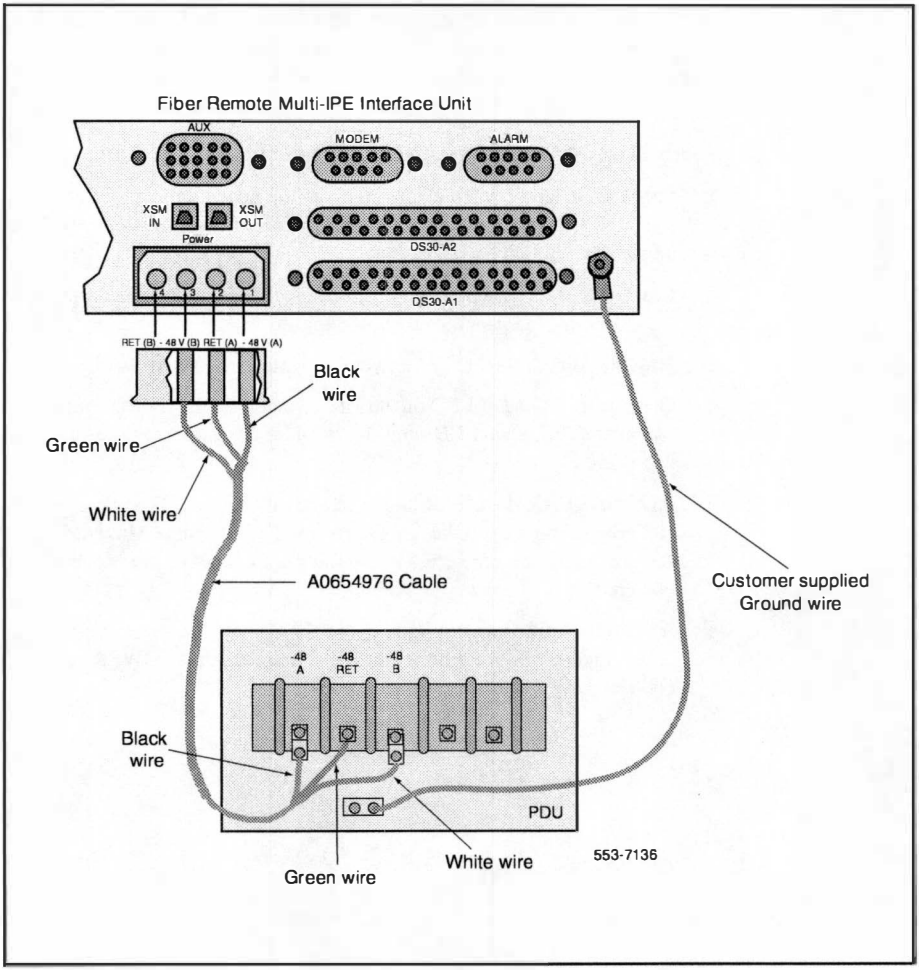
7 Observe the POWER LED on the Fiber Remote Multi-IPE Interface unit faceplate. This green LED should turn ON and stay lit as long as the unit is powered.

8 Push the ALARM CLEAR button to clear the alarms. The alarms will clear only if both the local and the remote Fiber Remote Multi-IPE Interface units are connected to the fiber-optic link and are communicating.

9 If POWER LED does not light, check the connection to the DC power source, the power source, and the Fiber Remote Multi-IPE Interface unit POWER connector. Correct the problem.

Figure 12 shows the power connection of the Fiber Remote Multi-IPE Interface unit to the Meridian 1 DC power source.

Figure 12
DC power connection of the Fiber Remote Multi-IPE Interface unit



Connecting the AC/DC Power Converter

A Fiber Remote Multi-IPE Interface unit is optionally supplied with an A0634498 AC/DC Power Converter to supply power to one Fiber Remote Multi-IPE Interface unit.

The AC/DC Power Converter plugs directly into a 110 V AC wall outlet. The DC power cord extends from the Power Converter to the -48 V DC power connector on the Fiber Remote Multi-IPE Interface unit I/O panel. Refer to Figure 13 for illustration of this power source connection.

To install the A0634498 AC/DC Power Converter:

1 Plug the DC power cord extending from the Power Converter into the -48 V, .6 A POWER connector on the Fiber Remote Multi-IPE Interface unit I/O panel.

2 Install the white wire onto the Ground lug at the Fiber Remote Multi-IPE Interface unit I/O panel, as shown in Figure 13.

3 Plug the A0634498 AC/DC Power Converter into the AC wall outlet.

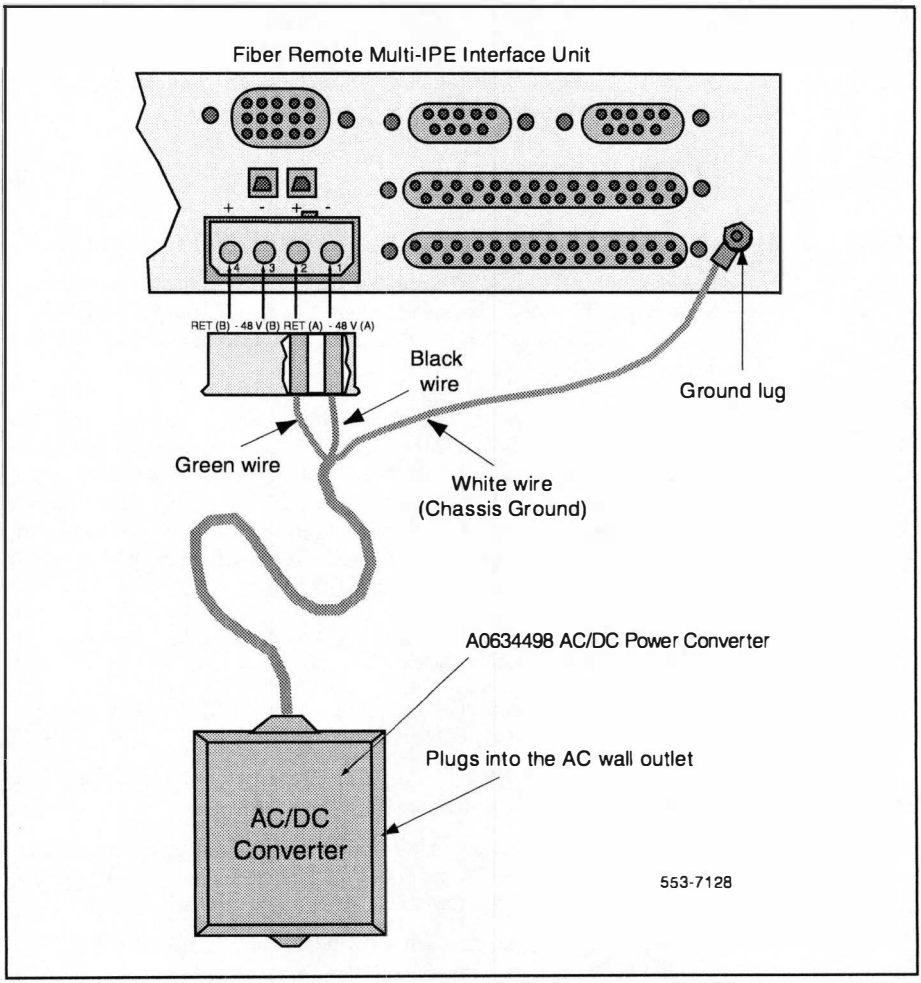
4 Observe the POWER LED on the Fiber Remote Multi-IPE Interface unit faceplate. This green LED should turn ON and stay lit as long as the unit is powered.

5 Push the ALARM CLEAR button to clear the alarms. The alarms will clear only if both the local and the remote Fiber Remote Multi-IPE Interface units are connected to the fiber-optic link and are properly powered.

6 If POWER LED does not light, check the Power Converter, the AC outlet, and the Fiber Remote Multi-IPE Interface unit POWER connector. Correct the problem.

Figure 13 illustrates the POWER connector on the I/O panel of the Fiber Remote Multi-IPE Interface unit..

Figure 13
DC system power source connection to the Fiber Remote Multi-IPE Interface unit



Remote IPE installation

The Remote IPE column is normally assembled in the factory with cards already installed.

If the Remote IPE column is not assembled in the factory, follow the instructions in *Meridian 1 system installation procedures (553-3001-210)*. It describes how to install the pedestal, the IPE Module, the top cap, the cards, and how to connect the power, the internal and external communication cables, and subscriber loops.

To install the PFTU to the Remote IPE, also follow the instructions in *Meridian 1 system installation procedures (553-3001-210)*.

Installing the internal cables to the Remote IPE module

In a standard IPE module installed in a Meridian 1 column, the connection between the IPE module backplane connectors SL0-SL3 and the Superloop Network card J1 and J2 faceplate connectors are made directly without routing the cables to their respective I/O panels.

In the Remote IPE column, the SL0-SL3 connectors are connected to the I/O panel using the NT8D92AB Controller to I/O panel cables. The number of cables required is equal to the number of superloops required to support the traffic conditions in the Remote IPE. A Remote IPE shipped from the factory will probably have these cables already installed. However, you can modify any standard IPE Module into the Remote IPE by installing these NT8D92AB Controller to I/O panel cables into an IPE module.

To install these cables, refer to Appendix, Figure 17 for the connection diagram and follow these steps:

1 Remove the back cover at the rear of the Remote IPE module to expose the backplane and the I/O panel connector cutouts.

2 Plug the NT8D92AB cable 24-pin block connector into the 24-pin block connector SL0 on the Remote IPE module backplane.

3 Install the NT8D92AB cable 24-pin Centronics connector onto the I/O panel of the Remote IPE module. Find a connector cutout to fit the cable connector mounting screw holes.

4 Repeat steps 2 and 3 for each NT8D92AB cable connecting SL1, SL2, and SL3 backplane connectors, if these are required.

5 Replace the back cover on the Remote IPE module.

Setting S1 and S2 switches at the remote site

Before you can install a Fiber Remote Multi-IPE Interface unit, you must:

— Configure the Fiber Remote Multi-IPE Interface using S1 and S2 dip-switches

— Install redundant fiber-optic connectors, if required

Table 11 lists switches S1 and S2 and their settings based on the Fiber Remote Multi-IPE Interface position in the system.

Table 11
Switch S1 and S2 settings

Function Selection	Switch and Position	Switch Setting
For **single** Fiber Remote Multi-IPE Interface unit	S1 Position 1 and Position 2	ON (at local and remote sites)
Fiber Remote Multi-IPE Interface at the **MMI terminal or modem end** of the daisy-chain	S1 Position 1	ON
	Position 2	OFF
Fiber Remote Multi-IPE Interface in the **middle of the daisy-chain**	S1 Position 1	OFF
	Position 2	OFF
Fiber Remote Multi-IPE Interface **system monitor address**	S1 Positions 3-8	Refer to Table 9
Physical location of the Fiber Remote Multi-IPE Interface	S2 Position 1	ON-Remote site
Reserved for future use	S2 Positions 3-8	OFF

Note: Switch position: **ON= Down** and **OFF= Up** for S1 and S2 switches.

Table 12 shows S1 switch position 3-5 that represent the system monitor address numbers from 0 to 63 at the remote site.

Table 12
System monitor address selection (Part 1 of 3)

Address	S1 Pos 3	S1 Pos 4	S1 Pos 5	S1 Pos 6	S1 Pos 7	S1 Pos 8
00	OFF	OFF	OFF	OFF	OFF	OFF
01	ON	OFF	OFF	OFF	OFF	OFF
02	OFF	ON	OFF	OFF	OFF	OFF
03	ON	ON	OFF	OFF	OFF	OFF
04	OFF	OFF	ON	OFF	OFF	OFF
05	ON	OFF	ON	OFF	OFF	OFF
06	OFF	ON	ON	OFF	OFF	OFF
07	ON	ON	ON	OFF	OFF	OFF
08	OFF	OFF	OFF	ON	OFF	OFF
09	ON	OFF	OFF	ON	OFF	OFF
10	OFF	ON	OFF	ON	OFF	OFF
11	ON	ON	OFF	ON	OFF	OFF
12	OFF	OFF	ON	ON	OFF	OFF
13	ON	OFF	ON	ON	OFF	OFF
14	OFF	ON	ON	ON	OFF	OFF
15	ON	ON	ON	ON	OFF	OFF
16	OFF	OFF	OFF	OFF	ON	OFF
17	ON	OFF	OFF	OFF	ON	OFF
18	OFF	ON	OFF	OFF	ON	OFF
19	ON	ON	OFF	OFF	ON	OFF
20	OFF	OFF	ON	OFF	ON	OFF
21	ON	OFF	ON	OFF	ON	OFF
22	OFF	ON	ON	OFF	ON	OFF
23	ON	ON	ON	OFF	ON	OFF
24	OFF	OFF	OFF	ON	ON	OFF

Table 12
System monitor address selection (Part 2 of 3)

Address	S1 Pos 3	S1 Pos 4	S1 Pos 5	S1 Pos 6	S1 Pos 7	S1 Pos 8
25	ON	OFF	OFF	ON	ON	OFF
26	OFF	ON	OFF	ON	ON	OFF
27	ON	ON	OFF	ON	ON	OFF
28	OFF	OFF	ON	ON	ON	OFF
29	ON	OFF	ON	ON	ON	OFF
30	OFF	ON	ON	ON	ON	OFF
31	ON	ON	ON	ON	ON	OFF
32	OFF	OFF	OFF	OFF	OFF	ON
33	ON	OFF	OFF	OFF	OFF	ON
34	OFF	ON	OFF	OFF	OFF	ON
35	ON	ON	OFF	OFF	OFF	ON
36	OFF	OFF	ON	OFF	OFF	ON
37	ON	OFF	ON	OFF	OFF	ON
38	OFF	ON	ON	OFF	OFF	ON
39	ON	ON	ON	OFF	OFF	ON
40	OFF	OFF	OFF	ON	OFF	ON
41	ON	OFF	OFF	ON	OFF	ON
42	OFF	ON	OFF	ON	OFF	ON
43	ON	ON	OFF	ON	OFF	ON
44	OFF	OFF	ON	ON	OFF	ON
45	ON	OFF	ON	ON	OFF	ON
46	OFF	ON	ON	ON	OFF	ON
47	ON	ON	ON	ON	OFF	ON
48	OFF	OFF	OFF	OFF	ON	ON
49	ON	OFF	OFF	OFF	ON	ON
50	OFF	ON	OFF	OFF	ON	ON
51	ON	ON	OFF	OFF	ON	ON
52	OFF	OFF	ON	OFF	ON	ON

Table 12
System monitor address selection (Part 3 of 3)

Address	S1 Pos 3	S1 Pos 4	S1 Pos 5	S1 Pos 6	S1 Pos 7	S1 Pos 8
53	ON	OFF	ON	OFF	ON	ON
54	OFF	ON	ON	OFF	ON	ON
55	ON	ON	ON	OFF	ON	ON
56	OFF	OFF	OFF	ON	ON	ON
57	ON	OFF	OFF	ON	ON	ON
58	OFF	ON	OFF	ON	ON	ON
59	ON	ON	OFF	ON	ON	ON
60	OFF	OFF	ON	ON	ON	ON
61	ON	OFF	ON	ON	ON	ON
62	OFF	ON	ON	ON	ON	ON
63	ON	ON	ON	ON	ON	ON

Installing the Fiber Remote Multi-IPE Interface unit

The Fiber Remote Multi-IPE Interface unit can be installed onto a wall or into a rack-mounted shelf that accommodates up to six Fiber Remote Multi-IPE Interface units. These units must be install within 30 feet from the Remote IPE and no further than 25 feet from the power source, because the cables connecting the Fiber Remote Multi-IPE Interface units to the Meridian 1 equipment are 30 feet long and the power cable is 25 feet long.

In some instances, a remote site may have multiple Fiber Remote Multi-IPE Interface units, which may be installed into the rack-mounted shelf. To perform this installation, refer to "Installing multiple Fiber Remote Multi-IPE Interface units into the shelf" on page 60

Installing the unit onto the wall

Two slotted holes are provided at the back of the Fiber Remote Multi-IPE Interface unit enclosure to mount the Fiber Remote Multi-IPE Interface unit on the wall such that the faceplate is located on the left-hand-side and the I/O panel at the right-hand-side of the unit.

To mount the Fiber Remote Multi-IPE Interface unit on the wall, refer to Figure 9 "Wall-mounting the Fiber Remote Multi-IPE Interface unit" on page 64 and follow these steps:

1 Find a location on the wall to give the Fiber Remote Multi-IPE Interface unit enough clearance to install the fiber-optic cables in the front and superloop cables in the back of the unit. Allow for a minimum of six inches of clearance in the front for the fiber-optic cables. Provide a minimum of 13 inches of clearance in the front.

2 Position the wall mount template on the wall and use a level to ensure horizontal positioning of the Fiber Remote Multi-IPE Interface unit.

3 Mark the three screw holes and the two alignment marks. Drill the screw holes.

4 Screw two number 8 screws into the wall board or plywood. The screw heads should be 1/16 inch away from the wall surface to allow you to insert the screw heads into the slotted holes on the bottom of the Fiber Remote Multi-IPE Interface unit as shown in Figure 9.

5 Place the wall mount bracket in the upper rear corner of the Fiber Remote Multi-IPE Interface unit and fasten it to the Ground lug with the attached nut and lock washer.

6 Position the Fiber Remote Multi-IPE Interface unit's holes over the two screws on the wall, insert the screws into the holes, and push the Fiber Remote Multi-IPE Interface unit to the left to engage the screws into the narrow of the slots.

7 Fasten the top of the wall mount bracket to the wall with the provided screw.

Installing superloop cables

The number of A0634496 Remote Superloop cables required to connect the Remote IPE I/O panel 24-pin Centurions connectors to the 37-pin D Shell SUPERLOOP connectors on the Fiber Remote Multi-IPE Interface I/O panel depends on the number of superloops required to support the Remote IPE site configuration.

Note: Use the superloop connection plan that you completed based on the traffic blocking criteria for Remote IPE segments and Table 1 "Superloop connection configurations" on page 13.

To install these cables and use longer screws to install them into the I/O panel cutouts:

1 Locate all the superloop connectors on the Remote IPE I/O panel designated to support Remote IPE sites over fiber-optic links.

2 Verify that you have configured and installed the appropriate version of the Fiber Remote Multi-IPE Interface unit (number of superloops and type of fiber supported). Refer to Table 2 "Equipment required to link Meridian 1 to Remote IPE sites" on page 14.

3 Plug the 24-pin Centronics A0634496 Remote Superloop cable connector into the designated 24-pin I/O panel connector on the Remote IPE module. Refer to Appendix, Figure 17 for the connection diagram.

4 Plug the 37-pin D Shell connector into the appropriate SUPERLOOP connector on the Fiber Remote Multi-IPE Interface unit I/O panel.

5 Repeat steps 3 and 4 for each superloop you have to connect.

Connecting the system monitor cable

The Fiber Remote Multi-IPE Interface unit is directly connected to a system monitor in the pedestal. Refer to Appendix, Figure 17 for the connection diagram.

To connect the system monitor cable from the Fiber Remote Multi-IPE Interface unit at the remote site:

1 Plug one end of the NT8D46AP cable 6-pin modular plug into the J5 jack on the system monitor in the pedestal.

2 Plug the other end of the NT8D46AP cable 6-pin modular plug into the XSM IN (J5) modular jack on the Fiber Remote Multi-IPE Interface unit.

Note: At the remote site the connection is made from the J5 of the system monitor to the XSM IN (J5) on the Fiber Remote Multi-IPE Interface unit.

3 Determine the system monitor address for each remote site by setting S1 positions 3-8 on the Fiber Remote Multi-IPE Interface unit. Before you select the address, you must determine which are the available system monitor addresses using the system TTY, as follows:

- Execute the **STAT XSM** command in **LD 37** to poll all system monitors. Correct any problems.
- Determine available system monitor addresses to be assigned to the Remote IPE module.
- Set master system monitor slave polling address range to cover the new Remote IPE system monitor address.
- Set Fiber Remote Multi-IPE Interface unit **S1** positions **3-8** for the new system monitor address at the remote site, refer to Table 12 for address selection.
- Re-connect the system monitor daisy-chain to include new Fiber Remote Multi-IPE Interface units, if any.
- Test the system monitor daisy-chain by executing the **STAT XSM** command in **LD 37** to ensure that every local and remote system monitor is responding to the master system monitor.

Note: In Fiber Remote Multi-IPE Interface units are daisy-chained at the remote site, the system monitor address becomes also the daisy-chain address.

Connecting the MMI terminal

An MMI terminal can be directly connected to the Fiber Remote Multi-IPE Interface unit at the remote site. Refer to Appendix, Figure 17 for the connection diagram.

Multiple Fiber Remote Multi-IPE Interface units at the remote site can be daisy-chained to allow sharing of the MMI terminal among all the Fiber Remote Multi-IPE Interface units in the chain.

Connecting the MMI terminal to a single Fiber Remote Multi-IPE Interface unit

An MMI terminal can be directly connected to the remote site Fiber Remote Multi-IPE Interface unit to provide a maintenance and testing facility for the Remote IPE and across the fiber-optic link for the Meridian 1 and the Fiber Remote Multi-IPE Interface units connected to Meridian 1. One of the main functions of the MMI terminal at the remote site is to access the system remotely using the Host SDI mode.

To connect the MMI terminal:

1 To connect the MMI terminal to the Fiber Remote Multi-IPE Interface I/O panel MAINT DB-9 male connector, use the NT7R66BA MMI Cable.

2 Plug the DB-9 female connector of the NT7R66BA MMI Cable into the DB-9 male MAINT connector on the Fiber Remote Multi-IPE Interface unit.

3 Plug the DB-25 male connector of the NT7R66BA MMI Cable into the DB-25 female connector on the MMI terminal. If the MMI terminal has other than DB-25 connector or a different gender, use an appropriate adapter.

Connecting the MMI terminal using a modem:

1 Use the NT7R66AA SDI Cable Kit to connect the DB-9 female MODEM connector on the Fiber Remote Multi-IPE Interface unit to the modem connector.

2 Plug the DB-9 male connector of the NT7R66AA SDI Cable Kit into the Fiber Remote Multi-IPE Interface DB-9 female MODEM connector.

3 Plug the other end of the cable into the modem connector.

Connecting the MMI terminal to multiple Fiber Remote Multi-IPE Interface units

Make sure that all the Fiber Remote Multi-IPE Interface units are properly configured for the daisy-chain addressing as shown in Table 8 "Fiber Remote Multi-IPE Interface configuration" on page 52.

To connect multiple (in this example we have 3 units) Fiber Remote Multi-IPE Interface unit in a daisy-chain configuration, refer to Figure 11 "Daisy-chaining of multiple Fiber Remote Multi-IPE Interface units" on page 72, except ignore the SDI connection. Follow the steps below:

1 Plug the DB-9 female connector on the A0634497 Maintenance Interface cable into the DB-9 male MAINT connector on the Fiber Remote Multi-IPE Interface unit #1.

2 Plug the other end of the A0634497 Maintenance Interface cable into the SDI connector on the Fiber Remote Multi-IPE Interface unit #2.

3 Plug a second A0634497 Maintenance Interface cable into the MAINT connector on the Fiber Remote Multi-IPE Interface unit #2.

4 Plug the other end of the second A0634497 Maintenance Interface cable into the SDI connector on the Fiber Remote Multi-IPE Interface unit #3.

5 Plug the NT7R66BA MMI Cable DB-9 female connector into the DB-9 male MAINT connector of the Fiber Remote Multi-IPE Interface unit #3.

6 Plug the DB-25 male connector on the NT7R66BA MMI Cable into the RS-232 MMI terminal port. If the MMI terminal has other than DB-25 connector, use an appropriate adapter or gender changer.

7 If you wish to connect a distant MMI terminal over a modem, install the NT7R66AA SDI Cable Kit between the MODEM connector on the Fiber Remote Multi-IPE Interface unit #3 and the modem.

8 Secure cables with tie-wraps as appropriate.

Connecting the fiber-optic link to the Remote IPE Module

The fiber-optic link connects the local Fiber Remote Multi-IPE Interface with the remote Fiber Remote Multi-IPE Interface.

The fiber-optic cable fibers, at each end of the link, must be terminated with an ST optical connector. This connector plugs into the ST optical connector on the Fiber Remote Multi-IPE Interface faceplate at the Remote IPE site.

For a single link, you need to install connectors on only two fibers at each end of the link, one for the transmit side and one for the receive side. For a redundant link, four fibers must have connectors installed at each end.For details of how to engineer and handle the fiber-optic link and the fiber-optic connectors, refer to See "Engineering the fiber-optic link" on page 32. Also, refer to Appendix, Figure 17 for the connection diagram.

> ***Note:*** Label optical fibers in the fiber-optic cable next to the ST optical connectors. Fibers labeled XMIT A and its pair RCV A at the local end of the link must be labeled RCV A and its pair XMIT A at remote end. Repeat the same procedure for the redundant link with XMIT B and RCV B. At the cross-connect typical designation is; Post A for receive fiber and Pos B for the transmit fiber. For illustration of the link fibers labelling, refer to Figure 6 in the *Product description* section of this document.

To connect the fiber-optic link to the Fiber Remote Multi-IPE Interface at the Remote IPE site:

1 Identify the link ST optical connectors labeled XMIT A and RCV A for a single link, or labeled XMIT A, RCV A, XMIT B, and RCV B for a redundant link.

2 Plug the link ST optical connector labeled XMIT A into the Fiber Remote Multi-IPE Interface faceplate ST optical connector labeled XMIT A.

3 Plug the link ST optical connector labeled RCV A into the Fiber Remote Multi-IPE Interface faceplate ST optical connector labeled RCV A.

4 Repeat steps 2 and 3 for the XMIT B and RCV B if you have a redundant link.

5 Route and secure the fiber-optic cable to prevent excessive bending and other physical damage.

Connecting the external alarm cable at the remote site

The Fiber Remote Multi-IPE Interface unit provides an external alarm input/output connector (ALM), which is connected to two external alarm inputs and one external alarm output at the Remote IPE site. Alarm inputs indicate external alarm contact closures at the Remote IPE site and the external alarm output indicates failure of the fiber-optic link.

Use a cable with a DB-9 male connector at one end and open wire at the other end. The other end can be customized with connector(s) to match your two external alarm input devices and one external alarm output device. The length of the cable depends on the distance between the Fiber Remote Multi-IPE Interface unit and the external alarm devices.

Table 13 lists the Fiber Remote Multi-IPE Interface unit ALM connector pin assignment at the Remote IPE site. This connector connects external alarms to the Fiber Remote Multi-IPE Interface unit. These alarms are reported over the fiber-optic link to the local Meridian 1 site.

Table 13
Remote IPE site DB-9 male ALM connector pinouts (remote site)

External Alarm Connection	Connector Pin
External alarm input #1 (activated by external contact closure)	9
External alarm input #2 (activated by external contact closure)	4
External alarm input return	5
External alarm output (activated by fiber-optic link failure)	6
External alarm output return	1

To install the external alarm cable:

1 Plug the cable DB-9 male connector into the DB-9 female ALM connector on the Fiber Remote Multi-IPE Interface unit.

2 Connect the other end of the cable open wires to two external alarm input devices and one external alarm output device. Observe the wire color codes and their corresponding pin assignments at the DB-9 connector to correctly connect alarm devices to the Fiber Remote Multi-IPE Interface unit.

Connecting the power source at the remote site

To install the DC power source to the Fiber Remote Multi-IPE Interface unit at the remote site, refer to "Connecting the DC power source" on page 75. To install and connect the Power Converter to the Fiber Remote Multi-IPE Interface unit at the remote site, refer to "Connecting the AC/DC Power Converter" on page 78.

Configuring the equipment

The configuration and administration of Remote IPE at one or more remote sites and the Meridian 1 at the local site are identical to the standard Meridian 1 configuration and administration and do not require special considerations.

However, there are some Fiber Remote Multi-IPE Interface initial setup functions that must be considered at either local or the remote site. These functions are administered over a man machine interface (MMI) port connected to a terminal at the local and the remote sites.

When configuring Remote IPE functions at the local and the remote sites you can configure the Superloop Network cards and the Peripheral Controller cards dedicated to the Remote IPE exactly the same way you configure any other standard Superloop Network cards and Peripheral Controller cards by using:

— Configuration Record programs LD 17 and LD 97

— MMI commands to configure the Fiber Remote Multi-IPE Interface parameters

Factory default parameter settings

The Fiber Remote Multi-IPE Interface units are set in the factory as listed in Table 14:

Table 14
Factory default parameter settings

Parameter	Default setting
Time	Central Standard Time
Date	Current
Name	Fiber
Alarm Enable/Disable	Enable
Alarm Self-Clearing Enable/Disable	Enable
Bit Error Alarm Threshold	10^{-10}

Configuring the cards

When the Remote IPE equipment is first installed, you must define the NT8D04 Superloop Network and NT8D01 Peripheral Controller cards dedicated to Remote IPE support.

To do this you must:

— print the current system configuration record to identify possible available superloops

— remove an existing superloop data block if it already exists for a superloop that is not dedicated to the Remote IPE

Note: To remove superloop data blocks, remove all terminal numbers (TNs) associated with the peripheral controller, disable the superloop, and remove the data block associated with the peripheral controller. You can also move data blocks of one superloop to a different superloop number using Move Data Blocks Program LD 25.

— configure a superloop data block to correspond to the Superloop Network card dedicated to the Remote IPE

— configure a peripheral controller data block to correspond to the Peripheral Controller card in the Remote IPE

Before you can define a superloop for Remote IPE, you must find available superloops in the system. To do this, logon and print system configuration data using Print Program LD 22.

Request CFN printout

Prompt	Response	Comment
REQ	PRT	Print request
TYPE	CEQU PKG, PSWV	Configuration data

From the report you can find unused superloops, which you can use for the Fiber Remote Multi-IPE Interface application.

CFN configuration data print format- find unused superloop

CEQU		
MPED	SD/DD/4D/8D	Prints maximum peripheral density for the system (use 8D for systems with IPE)
TERM	xxx xxx xxx...	Prints all terminal loops
REMO	xxx xxx xxx...	Prints remote EPE loop numbers configured in LD 17
SUPL	xxx xxx xxx...	Lists all local Superloop Network card superloop numbers

To change the system configuration record and to configure the Peripheral Controller card at the Remote IPE site, load Configuration Record Program LD 17 and Configuration Record Program LD 97.

To change the system configuration record (LD 17)

Prompt	Response	Comment
REQ	CHG	Change the configuration record
TYPE	CFN	Configuration record
CEQU	YES	Change equipment
MPED	8D	Peripheral density

To configure the Remote IPE site (LD 97)

REQ	CHG	Change definition
TYPE	XPE	Remote Peripheral Controller ID
XPEC	2	Card position
LOC	SCLARA	Remote site location example. Use any 6 alphanumeric characters to identify the remote site
MED		
RGTP	(8)/16	Default umber of concurrent ringers. Change to a maximum of16 ringers capacity for all ringers except the old DC version

After you have defined the new Peripheral Controller, define the superloop for the Superloop Network card designated to support the Remote IPE.

To define a carrier superloop

Prompt	Response	Comment
REQ	CHG	Adding a new Superloop Network card
TYPE	SUPL	Adding a superloop for the Superloop Network card.
SUPL	0–156	Superloop number
SLOT	(L)/R	Superloop card side for the Superloop Network card, where L (left) is default position.
XPEC	1–95	Peripheral Controller card previously equipped.

To configure new Host SDI maintenance and service change, load Configuration Record Program LD 17 and Configuration Record Program LD 97.

Configuring the SDI port for the Superloop Network card connection (LD 17)

REQ	CHG	Change the SDI record
TYPE	CFN	Configuration record
IOTB	YES	
HIST		I/O terminal history file buffer length
ADAN	NEW/TTY 0–15	Add, change, or remove an I/O device, type aaa, or port x
USER	BUG, MTC, SCH	Enter one of the output message types that will be the message of this port
XSM	(NO)	SDI port for the system monitor

To enable the superloop, load Maintenance and Diagnostic Program LD 32 and execute the **ENLL sl** command.

To enable the superloop sl

Command	Response	Comment
ENLL sl	ok & prompt	Enables specified superloop **sl**

To remove the configuration of the Remote IPE superloop, load Maintenance and Diagnostic Program LD 32 and execute the **DISL sl** command to disable the superloop, and then load Configuration Record Program LD 97 to delete the configuration records of the superloop for the Superloop Network card and the Peripheral Controller card.

To delete the configuration record for the superloop

Prompt	Response	Comment
REQ	CHG	Deleting the Superloop Network card configuration record
TYPE	SUPL	Superloop
SUPL	X8	Remove record for superloop number 8

To delete the configuration record for the Remote IPE module

REQ	CHG	Change configuration record
TYPE	XPE	Remote IPE
XPEC	X2	Delete configuration record for the Peripheral Controller 2

To check the status of the specified superloop, load the LD 32 and execute the **STAT sl**, where **sl** is the superloop number.

Configuring the Fiber Remote Multi-IPE Interface unit

The configuration and administration of the Fiber Remote Multi-IPE Interface at the local or the remote site consists of the following:

- Selecting the MMI terminal modes
- Setting modem parameters
- Configuring fiber-optic link performance criteria
- Performing maintenance functions
- Conducting test and diagnostic functions

Selecting the MMI terminal modes

The MMI terminal can be set in the Host SDI or the MMI mode. When the MMI terminal is in the SDI mode, you can perform system administration tasks from the local or the remote site. When the MMI terminal is in the MMI mode you can:

- perform Fiber Remote Multi-IPE Interface functions such as display status, logs, performance information, history, and messages
- enable or disable alarms
- clear errors and logs
- set performance parameters
- specify tests

Selecting the MMI mode

In the MMI mode, a terminal is connected to the MMI port at the local Fiber Remote Multi-IPE Interface unit and another terminal is connected to the MMI port at the Fiber Remote Multi-IPE Interface unit at the remote site. Each terminal can control MMI functions at the local and across the fiber-optic link at the distant site. In a daisy-chain configuration an MMI terminal can access any Fiber Remote Multi-IPE Interface unit in the chain at the local or remote site.

The default MMI interface characteristics are set in the Fiber Remote Multi-IPE Interface unit as follows:

- Speed: 2400 bps

— Character width: 7 bits

— Parity bit: mark

— Stop bit: 1

Note: This is a singe user system, i.e. only one terminal can be active on the system at the time.

Logging in. The MMI mode is accessed from the initial (INIT) mode by entering **L or LOGIN** on the terminal to log in. For multiple Fiber Remote Multi-IPE Interface units connected in a daisy-chain, to log in to the specified Fiber Remote Multi-IPE Interface, enter **L <xx>**, where **xx** is the address of a specific Fiber Remote Multi-IPE Interface unit in the chain. Refer to Table 9 "Fiber Remote Multi-IPE Interface and system monitor address selection table" on page 53.

Entering password. After you logged in, you will be prompted to enter the password. The password is **FIBER** and it must be entered in all capital letters.

Exiting the MMI mode. To exit the MMI mode and return to the INIT mode, enter **Q** at the MMI terminal.

Selecting Host SDI mode

In the Host SDI mode, a terminal is connected to the MAINT port or to the MODEM port (through a modem) at the Fiber Remote Multi-IPE Interface unit. This terminal becomes the Meridian 1 maintenance and service change TTY. At the Meridian 1 site, a single Fiber Remote Multi-IPE Interface unit connects a terminal to its MAINT port and an SDI card to its SDI port. In a daisy-chain configuration, the MMI terminal is connected to the MAINT port of the first unit in the chain and the SDI card is connected to the last unit in the chain.

Note: When a terminal is in the Host SDI mode and is active over the fiber-optic link, other MMI terminals can not execute the MMI (DISTANT) commands, for example; D S D command, until the Host SDI mode stops communication over the link or the mode is changed into the MMI mode.

For the MAINT port, at the Remote IPE site, to be able to communicate over the SDI port at the local site, the interface characteristics must be the same at both sites:

— Speed: 2400 bps

— Character width: 7 bits

— Parity bit: mark

— Stop bit: 1

In this mode, the remote MMI terminal becomes a Meridian 1 system TTY that can access overlays and perform system configuration, maintenance, and diagnostics, which are the same functions performed by the local Meridian 1 system TTY.

To log into the host for SDI operation, you should first log in using the MMI terminal in the MMI mode, then you should log into the terminal as host:

FII:: >L	Login command
Enter Password > **FIBER**	Type in the password in capital letters.
FII::> **HO**	To access the Host SDI mode
Enter Password > **HOST**	Enter the password **HOST**
Host Busy. Barge In (Y or N) Y	May want to barge in but the connection may be denied if an other terminal is active in the Host SDI mode.

The Host SDI mode is accessed from the MMI mode by entering **HOST** at the terminal or TTY. In this mode you can configure and maintain the entire Meridian 1 system. Figure 14 shows that, for example, LD 32 can be activated to perform loopback testing.

To exit this mode, enter **@@@**.

Configuring the MMI modem

To connect a distant MMI terminal to a Fiber Remote Multi-IPE Interface unit at either the local or the remote site, the Fiber Remote Multi-IPE Interface provides the MODEM DB-9 female connector with a DTE interface. This connector connects a Hayes-compatible auto-answering modem to the Fiber Remote Multi-IPE Interface unit allowing an MMI terminal to perform local maintenance and through the fiber-optic link to perform the far-end maintenance. For proper operation, the modem must be configured as follows:

— Speed -2400 baud

— Auto-answer - ON

— Carrier loss delay - 5/10 second or less

— Local echo - OFF

— Result codes - disabled

— Character width - 7 bits

— Parity bit - mark

— Stop bit - one

Table 15 lists the pin assignment of the MODEM DB-9 female connector that connects the Fiber Remote Multi-IPE Interface unit to the modem.

Table 15
Fiber Remote Multi-IPE Interface MODEM connector pin assignment

Pin number	Function
2	Receive data from modem
3	Transmit data to modem
5	Signal ground

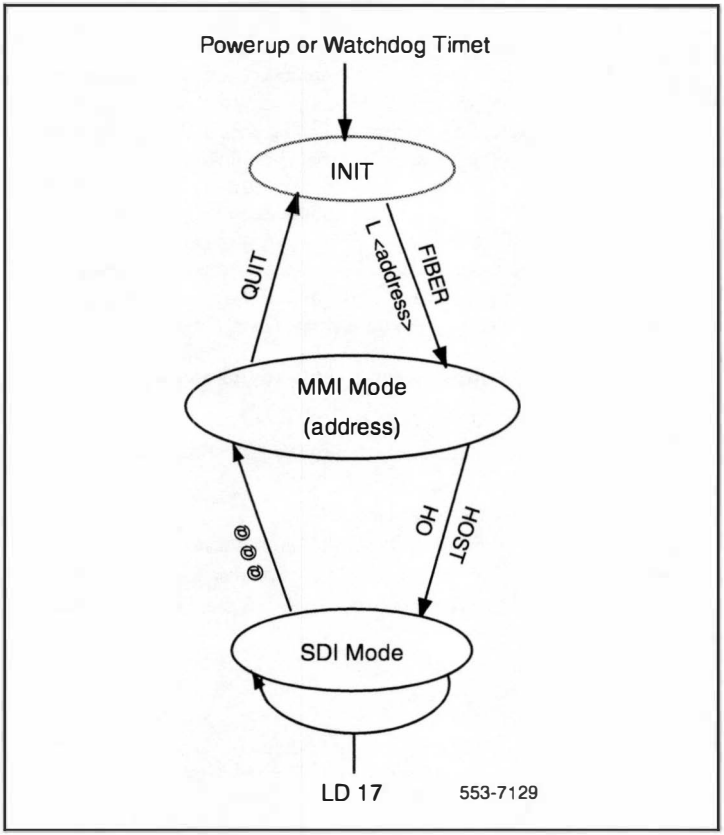
Use a terminal or set the computer into the terminal mode and connect it to the modem to be able to configure the modem.

To configure the modem parameters using a character string or a dip-switch, where applicable:

1. Set baud rate by sending the AT<cr> command to the modem at the desired baud rate. This sets the modem baud rate. If the modem is already set with no echo or result codes, the modem will not reply back to the terminal the result of the command action.
2. Set auto-answer to ON. If the modem has a dip-switch, set switch position #5 to the UP position, otherwise type ATS0=1&W0&Y0<cr>.
3. Set carrier loss delay to 5/10 second or less. Type ATS10=5<cr>. This sets the hang-up time of 1/2 second upon loss of carrier.
4. Disable local echo. If the modem has a dip-switch, set switch position #4 to the DOWN position. Otherwise, type ATE0&W0&Y0<cr>.
5. Disable result codes. If the modem has a dip-switch, set switch position #3 to the UP position. Otherwise, type ATQ1&W0&Y0<cr>.

Figure 14 shows modes that a terminal can be in and paths taken to transition from one mode to the next. The three modes are Initial, MMI, and SDI. The words in quotation marks shown along the paths must be entered on the terminal to go from one mode to the next.

Figure 14
TTY or terminal modes at the local and the remote sites



Configuring the Fiber Remote Multi-IPE Interface

To configure the Fiber Remote Multi-IPE Interface using the MMI terminal, you must logon, enter the password, and use appropriate MMI commands.

> *Note:* The commands are not case sensitive (you can use upper or lower case letters). The exception is the password, which must always be entered in upper case.

Before you start configuring the Fiber Remote Multi-IPE Interface, you must make sure that the communication is established with the distant end otherwise, the MMI commands will not have effect at the far-end. Commands affecting the far-end can be executed only when the distant end is communicating and the Microlink is up.

To verify that the communication is established, display the status at each end of the fiber-optic link by executing the **D S** and **D S D** commands on the MMI terminal to display the superloop and the fiber-optic link status at the near-end and the far-end of the link. If the Alarm Level is 0 for et least one link at both ends the communication is established.

To display near-end (local) link status:

```
FII:: > D S
Fiber Remote IPE S/N 2502-R3 Software Version 3.11 5/15/96 10:45
Local Site
In Alarm Status: NO
Fiber A Threshold Alarm Active: NO
Error Rate: E-99 Todays Max: 5/15/96 11:58 Error Rate: E-7
Super Loop 1 NORMAL Super Loop 21 INACTIVE
```

To display far-end (distant) link status:

```
FII::> D S D
Distant End Ready
Distant Status
Enter 'S' to Cancel Function
D S
Fiber Remote IPE S/N 2502-R3 Software Version 3.11 5/15/96 10:45
Remote Site
In Alarm Status: NO
Fiber A Threshold Alarm Active: NO
Error Rate: E-99 Today's Max: 5/15/96 11:58 Error Rate: E-10
Super Loop 1 NORMAL Super Loop 21 INACTIVE
```

After the communication with the distant site has been verified, you can display the current Fiber Remote Multi-IPE Interface configuration parameters to decide which parameters should be changed to meet the system requirements.

To display the near-end current Fiber Remote Multi-IPE Interface configuration:

```
FII::> D C
Fiber Remote IPE S/N 2502-R3 Software Version 3.11 5/15/96 10:45
Local Site
Alarm Enabled: YES Self Clearing Enabled: YES
Remote XSM Address 0X00
Current Fiber Alarm Threshold Value E-9

Current Dip Switch Settings (S1...S8) ON ON OFF OFF OFF OFF OFF
OFF
2400 Baud Single Terminal Mode Multidrop Address 0
```

To display the far-end (distant) current Fiber Remote Multi-IPE Interface configuration:

```
FII::> D C D
Distant End Ready
Distant Configuration
Enter 'S' to Cancel Function
D C
Fiber Remote IPE S/N 2502-R3 Software Version 3.11 5/15/96 10:45
Remote Site
Alarm Enabled: YES Self Clearing Enabled: YES
Remote XSM Address 0X00
Current Fiber Alarm Threshold Value E-9

Current Dip Switch Settings (S1...S8) ON ON OFF OFF OFF OFF OFF
OFF
2400 Baud Single Terminal Mode Multidrop Address 0
```

To change the fiber-optic link alarm threshold, execute the **S A** command on the MMI terminal. This sets the bit error per minute alarm threshold for the link.

To configure the fiber-optic link alarm thresholds:

```
FII::> S A
Alarm Threshold: Current Value E-9 New Value E-10
```

Alarm Threshold—Number of bit errors per minute. E-6 represents 10^{-6} or 1 error in 1 million bits or 3000 error bits/min, E-7 represents 10^{-7} or 1 error in 10,000,000 bits or 300 error bits/min, E-8 represents 10^{-8} or 1 error in 100,000,000 bits or 30 error bits/min, E-9 represents 10^{-9} or 1 error in 1,000,000,000 bits or 3 error bits/min, and E-10 represents 10^{-10} or 1 error in 10,000,000,000 bits or 1error bits/min.

To configure site name, time, and date:

FII:: >	Prompt requesting an MMI command
FII::> S N	Set name
Change Site Name (YES or NO) Y	To change the site name
Enter Site Name= SC	New site name
Change Link Identifiers (YES or NO) Y	To change link IDs
ID for Superloop 1 004 1	Superloop and shelf number
ID for Superloop 2 008 1	Superloop and shelf number
ID for Superloop 3012 2	Superloop and shelf number
ID for Superloop 4016 2	Superloop and shelf number
FII::> S T	To set time
Current Time 10:06:14 *10:15:25* Current Time 10:15:25	Enter correct time at the cursor, if required.
FII::> S D	To set date
Current Date 8/10/95*18/11/95* Current Date 8/11/95	Enter correct date at the cursor, if required.

Note: Time and date should be set correctly to allow correlation of the Remote IPE Alarm Log with error messages in the Meridian 1 History File.

Table 16 lists MMI commands used to display and configure carrier parameters such as setting alarm thresholds, setting time and date, configuring fiber-optic links, connecting to the SDI port, and testing the fiber-optic link and interfaces to the link.

Table 16
MMI commands used in displaying, checking, and setting the fiber-optic parameters (Part 1 of 3)

Command	Description
A D	Alarm disable. Disables all alarms.
A E	Alarm enable. Enables all alarms.
C A	Clear alarm. Clears all alarms and resets the fiber-optic link bit error rate counters.

Table 16
MMI commands used in displaying, checking, and setting the fiber-optic parameters (Part 2 of 3)

Command	Description
D C [P]	Display configuration. Displays current near-end configuration such as time, date, name, and link bit error threshold.
D C D	Display configuration [Pause]. Displays current far-end configuration such as time, date, name, and link bit error threshold.
D S [P]	Display status [Pause]. Displays near-end superloop and fiber-optic link status.
D S D	Display status distant. Displays far-end superloop and fiber-optic link status.
H or ?	Help. Displays the help screen.
HOST or HO	Connect the terminal to the SDI port. The password is **HOST**. Enter password in all capital letters.
L	Log into the MMI terminal for one Fiber Remote Multi-IPE Interface. The password is **FIBER**.
L xx	Log into a specific superloop when the system has more than one Fiber Remote Multi-IPE Interface connected in a daisy-chain, where xx is the Fiber Remote Multi-IPE Interface address in the chain. The password is also **FIBER**. Enter password in all capital letters.
Q	Logs the terminal user out.
S A	Set link bit error per minute alarm threshold.
S C	Set alarm self-clearing function to either "enable" or "disable".
S D	Set date or verify current date.
S L	Sets link. Configures which fiber-optic link (A or B) is selected to transmit data.

Table 16
MMI commands used in displaying, checking, and setting the fiber-optic parameters (Part 3 of 3)

Command	Description
S N	Set name. Sets the name for the site and superloop number and shelf number. The site name can be 9 characters long and the superloop number can be 3 characters long and shelf can be one to two characters long.
S T	Set time or verify current time.
T A	Test all. Initiates a series of pre-programmed tests on the near and far end superloops and fiber-optic links. Test duration can be set from 1 to 98 minutes. By entering 0, the tests run one time. To stop testing enter **STOP**.
T FI	Test fiber. Initiates a series of pre-programmed tests on the fiber-optic links. Test duration can be set from 1 to 98 minutes. By entering 0, the tests run one time. To stop testing enter **STOP**.
T SL	Test near-end superloop. Initiates a series of pre-programmed tests on the near-end superloops. Test duration can be set from 1 to 98 minutes. By entering 0, the tests run one time. To stop testing enter **STOP**.
T SL D	Test far-end superloop. Initiates a series of pre-programmed tests on the far-end superloops. Test duration can be set from 1 to 98 minutes. By entering 0, the tests run one time. To stop testing enter **STOP**.
@@@	Terminates the terminal connection

Remote IPE acceptance testing

This section describes the acceptance testing of the Meridian 1 Remote IPE and the fiber-optic link connecting Meridian 1 to the Remote IPE at distances of up to 15 miles for single-mode fibers. The purpose of acceptance testing is to verify that the functions and features of the Remote IPE are operating correctly and that the link is operating as intended.

Acceptance testing overview

Acceptance testing is conducted after the system has been installed, powered up, and appears to be functioning correctly, that is, all LEDs, displays, and system messages indicate that the system is operating correctly. The Remote IPE acceptance testing should be conducted after:

— A previously installed Meridian 1 system is upgraded with Remote IPE equipment and operates correctly without Fiber Remote Multi-IPE Interface connection to Meridian 1 and Remote IPE equipment

— A newly installed system with Remote IPE equipment appears to operate correctly

Acceptance testing verifies the operation of Meridian 1 functions and features at the remote site equipped with Fiber Remote Multi-IPE Interface units and the Remote IPE.

Acceptance testing consists of:

— Checking the system

— Preparing the system for testing

— Testing Meridian 1 functions at the Remote IPE site

Checking the system

After Remote IPE site has been installed and configured, you can visually inspect Remote IPE cards and to make sure that they are operating correctly, observe their LEDs:

— On the Superloop Network card at the local site, check the card LED located at the top of the faceplate. If the LED on the Superloop Network card is Off, the card is enabled and operating correctly. If the card LED is Off and the Fiber Remote Multi-IPE Interface alarm LEDs are On, the card is enabled and operating but the Fiber Remote Multi-IPE Interface or the fiber-optic link is faulty. If the card LED is On, the card is disabled or faulty. To enable the Superloop Network card or to correct a problem, go to "Remote IPE fault isolation and correction" on page 136 in the Maintenance section of this manual.

— On the Peripheral Controller card at the remote site, check the card LED located at the top of the faceplate. If the LED on the Peripheral Controller card is Off, and the Fiber Remote Multi-IPE Interface alarm LEDs are also Off, the card and Fiber Remote Multi-IPE Interface are operating correctly. If the card LED is Off and the Fiber Remote Multi-IPE Interface alarm LEDs are On, the card is enabled and operating but the Fiber Remote Multi-IPE Interface or the fiber-optic link is faulty. If the card LED is On, the card is disabled or faulty. To enable the Peripheral Controller card or to correct a problem, go to "Remote IPE fault isolation and correction" on page 136 in the Maintenance section of this manual.

— Check the hexadecimal display on the Peripheral Controller card. Refer to Appendix A to identify hexadecimal codes displayed by the Peripheral Controller card during self-test.

If the display and all indicator LEDs on the Remote IPE equipment indicate good operating conditions, the equipment is functional and you may proceed with setting up the necessary equipment for this test.

Setting up test conditions

To conduct acceptance testing, you must have a setup that can verify basic Meridian 1 functions and features initiated and terminated at the Remote IPE site. You may be able to use the system as configured at the site according to the customer requirements and not have to modify the configuration to perform the acceptance testing.

To conduct the acceptance testing, make sure that the Remote IPE at the remote site contains at least one IPE (line) card with at least two telephones connected to its subscriber loops. If possible, use some 2500 telephones to check the ringing generator and some digital telephones to check the dual tone multifrequency (DTMF) operation. Also, make sure that an MMI terminal is connected to the MMI port through the Fiber Remote Multi-IPE Interface unit.

Performing acceptance testing

Since functions and features at the Remote IPE site are identical to functions and features at the local Meridian 1 local site, the main purpose of acceptance testing is to verify that fiber-optic equipment is functioning correctly. This can be accomplished by:

— performing basic voice calls

— using the MMI terminal to configure and maintain Remote IPE and Fiber Remote Multi-IPE Interface equipment

— checking the protection switching of the fiber-optic link

Voice calls

A voice call can be established between two voice terminals across a network, between two terminals on the same PBX, and even between two terminals on the same line card.

Acceptance testing of Remote IPE voice calls is conducted when testing the following basic system features supported by telephone sets connected to subscriber loops at the remote site:

— placing a call to the remote site

— placing a call in call hold/call retrieve

Placing a call to the remote site

From the local Meridian 1 site, place a call to a Remote IPE site by dialing a remote station directory number (extension number).

> ***Note:*** Meridian 1 treats Remote IPE subscriber loops as local loops; thus, you need to dial only the extension number to access that station.

To perform a call test:

1 From a terminal at the local Meridian 1 site, dial a terminal at the Remote IPE site and establish an active call connection.

2 Verify voice transmission by talking with the person at the other terminal. Make sure the speech is clear in both directions.

3 Maintain the connection and ask the person at the remote site to test basic calling features such as call hold/call retrieve.

4 Terminate the call.

Call hold/call retrieve

Call hold is used to place an active call on hold in order to answer an incoming call or place an outgoing call. After releasing an incoming or an outgoing call, you can retrieve the call on hold.

To perform a call hold/call retrieve test:

1 From a terminal at the local Meridian 1 site, dial a terminal at the Remote IPE site and establish an active call connection.

2 Verify voice transmission by talking with the person at the other terminal.

3 Press the Hold key at the remote site to place the active call on hold.

Note: To find out how to use the feature keys on different terminals, consult the user manual supplied with the terminal.

4 Now, place an outgoing call from the terminal at the remote site by dialing an idle terminal located at the local Meridian 1 site.

5 Complete this outgoing call by first checking the voice clarity in both directions, and hang up.

6 Have another terminal call you while the first call is still on hold.

7 Answer the incoming call and place it on hold.

8 Retrieve the call first held.

9 Complete the call and hang up.

10 Retrieve the second call on hold.

11 Complete the call and hang up.

You may repeat this test for terminals connected to different subscriber loops on the same line card or for different subscriber loops on different line cards in the Remote IPE module. By making these calls, you generate traffic, which will be shown in the traffic report.

Checking the MMI terminal operation

Connect an MMI terminal to the Fiber Remote Multi-IPE Interface unit at the local site and another MMI terminal to the Fiber Remote Multi-IPE Interface at the Remote IPE site.

1 Set the current mode of the MMI terminal to MMI mode by logging on and by entering **L** or **L xx**, where **xx** is the Fiber Remote Multi-IPE Interface address in a multiple unit daisy-chain configuration. Enter the password **FIBER** in solid caps.

2 Check the status of near-end superloops and the fiber-optic link by executing the **D S [P]** command.

3 Check the status of the superloops and the fiber-optic link at the far-end by executing the **D S D** command. This command is sent over the fiber-optic link to the Peripheral Controller card for execution.

4 Check the response to this command for the local and remote sites.

5 Check the log file content by executing the **D A [P]** to print near-end log messages from the file starting with the oldest message. Examine the messages.

6 Check the log file content by executing the **D A D** to print far-end log messages from the file starting with the oldest message. Examine the messages.

Additional exercise of the MMI terminal will be conducted when testing the fiber-optic link protection switching.

Checking link protection switching

To verify that the fiber-optic link protection switching is operating correctly, conduct the following tests with the span:

— manual switch-over

— forced switch-over

Note: These tests can be conducted only with a redundant link configuration.

Manual switch-over

This is a bidirectional switch-over. To conduct this test:

1. Check the status of the fiber-optic link by executing the **D S** command from the MMI terminal. Make sure that both the primary and the redundant links are functional without an alarm condition on the Fiber Remote Multi-IPE Interface faceplate.
2. Establish a call from the Remote IPE to the local Meridian 1 site. Refer to "Voice calls" on page 114 to establish the call.
3. Assuming that the traffic is carried by the primary link, perform the following step.
4. Switch the link to the secondary by unplugging the primary link connector from the Fiber Remote Multi-IPE Interface faceplate XMIT A connector.
5. Verify that the call is still established over the secondary link.
6. Reconnect the link ST optical connector into the XMIT A connector on the Fiber Remote Multi-IPE Interface faceplate.
7. Switch the link back to the primary by unplugging the secondary link connector from the Fiber Remote Multi-IPE Interface faceplate XMIT B connector.
8. Verify that the call is still established over the primary link.
9. Reconnect the link ST optical connector into the XMIT B connector on the Fiber Remote Multi-IPE Interface faceplate.

Forced switch-over

This is a bidirectional switch-over. To conduct this test:

1 Check the status of the fiber-optic link by executing the **D S** command from the MMI terminal. Make sure that both the primary and the redundant links are functional without an alarm condition on the Fiber Remote Multi-IPE Interface faceplate.

2 Establish a call from the Remote IPE to the local Meridian 1 site. Refer to "Voice calls" on page 114 to establish the call.

3 Assuming that the traffic is carried by the primary link, perform the following step.

4 Switch the link to the secondary by executing the Set Link command **S L B** to select the redundant link **B** using the MMI terminal.

5 Verify that the call is still established over the secondary link.

6 Executing the Set Link command **S L A** to select the primary link **A** using the MMI terminal.

7 Verify that the call is still established over the primary link.

Fault recovery test

This test verifies the recovery of the fiber-optic link and the Fiber Remote Multi-IPE Interface units after the loss of power at one end. To perform this test:

1 Unplug the power connector on the Fiber Remote Multi-IPE Interface unit I/O panel.

2 Observe that all LEDs on the unit are OFF.

3 Reinstall the power source connector into the Fiber Remote Multi-IPE Interface unit I/O panel power connector. Observe the LEDs.

4 The Power LED on the Fiber Remote Multi-IPE Interface should come ON and stay ON upon completion of a successful self-test.

5 Press the Reset button to turn OFF the alarm LEDs. They should turn OFF and stay OFF if the fiber-optic link recovered from the power failure.

6 Place a call across the link to verify its operation.

7 Place the MMI terminal in the Host SDI mode and load the LD 60 overlay to switch the system clock controller from 0 to 1 or vice versa.

8 Switch system clock from active to standby by executing the **SWCK** command.

9 Get status of system clock 0 or 1 by executing the **SSCK 0, 1** command.

10 Check the established call(s) and make sure they have not been dropped. If the call(s) are not established, the Phase-Lock-Loop (PLL) is out of lock due to clock switching. The status message may be XM1000 to indicate a glitch and PLL is unlocked. Find the problem and reestablish the PLL lock.

Removing the test setup

After acceptance testing has been completed and the results show that the system is operating correctly, you should remove the setup you used to conduct the testing and restore equipment according to the customer configuration.

If you used the actual customer configuration to perform these tests, you do not have to change or remove the setup.

Generating traffic reports

Use system traffic report to identify calls made during acceptance testing from the Remote IPE site and to the Remote IPE site.

To verify traffic generated during acceptance testing, use the following command to print the report:

TOPS r r

The parameters for this command are:

r r are report options. This must be one or more of the following numbers:

1 = Network traffic report

2 = Service loops traffic report

5 = Selected terminals traffic report

For more information on traffic reports, refer to the Traffic control program LD 02 in *X11 input/output guide (553-3001-311)* and *Traffic measurement formats and output (553-2001-450).*

Remote IPE maintenance

This section describes Meridian 1 maintenance tools and procedures for identifying Fiber Remote Multi-IPE Interface, superloop, fiber-optic link, and Remote IPE faults, locating defective equipment, correcting problems by fixing or replacing defective equipment, and verifying the operation of the Remote IPE after corrections or replacements have been made.

Maintenance overview

Remote IPE maintenance deals with two types of problems:

— Installation

— Operation

Installation problems are created during the installation of an entire Meridian 1 with Remote IPE or during the addition of the Remote IPE to an existing system.

Operation problems occur when components fail or equipment is accidentally disconnected during normal system operation.

In either case, identifying the problem should be approached systematically. A problem may have more than one cause. To isolate the cause, a knowledge of Meridian 1 Remote IPE operation is required. This information can be found in "Product description" on page 9 in this manual. Once the cause is identified, the problem can be corrected by replacing the defective card or Fiber Remote Multi-IPE Interface unit, connecting accidentally disconnected cables, or correcting the system software problem.

Meridian 1 provides built-in self-diagnostic indicators and software and hardware tools. These diagnostic facilities simplify system troubleshooting and reduce mean-time-to-repair (MTTR).

This document focuses on the maintenance of Fiber Remote Multi-IPE Interface units at both sides of the fiber-optic link. System installation and maintenance guide sections of *Meridian 1 general maintenance information (553-3001-500)*, *Meridian 1 fault clearing (553-3001-510)*, and *Meridian 1 hardware replacement (553-3001-520)* describe how to maintain the entire Meridian 1 system. This chapter describes how to maintain the Fiber Remote Multi-IPE Interface unit as an integral part of Meridian 1.

It also describes how to maintain and troubleshoot the Superloop Network and the Peripheral Controller cads dedicated to the Remote IPE operation.

Diagnostic tools

Diagnostic tools are used to troubleshoot problems in Meridian 1 including problems with the Fiber Remote Multi-IPE Interface unit. When diagnosing Fiber Remote Multi-IPE Interface unit and Remote IPE problems, you may have to use more than one of these tools.

Hardware diagnostic tools

Recommended test equipment:

— Optical power meter (Fotec Model M712A or equivalent)

— Fiber-optic tracer (low power visible light source)

— Adjustable optical attenuator

— Fiber-optic patchcords and adapters (matching type of fiber and connectors for the single-mode and multi-mode fibers)

— Inspection microscope

— Pure isopropyl alcohol lint-free wipes

— Aerosol duster

Optional equipment:

— 1300 nm light source (LED or laser)

— Visual fault locator (high power visible light source)

— OTDR (Optical Time Domain Reflectometer), rent for occasional use

— Fiber identifier receiver

Meridian 1 hardware diagnostic tools consist of:

— card self-tests

— LED indicators

— display codes

— enable/disable switches

Test equipment

To facilitate the troubleshooting of the Fiber Remote Multi-IPE Interface and the fiber-optic link, it is recommended to have on hand an optical power meter (Fotec Model M712A or equivalent) to test the signal level of the optical transmitter and the signal level received over the fiber-optic link. Receiver sensitivity limit of -30 dBm can be measured. An adjustable fiber-optic attenuator can be used to test the sensitivity of the optical receiver. The patchcords are used to connect the meter, the light source, and to loopback the link or the Fiber Remote Multi-IPE Interface while performing the tests. The loopback patchcords (provided with equipment) should be attenuated by 15 dB for the single-mode and 10 dB for the multi-mode fibers.

Troubleshooting the fiber-optic link

To identify the problem with the fiber-optic link, you must check the attenuation across the entire link, the signal level at the receiver and the signal level at the transmitter, as follows:

— Unplug the connector at the receiver and using the power meter measure the received power on the link and compare it with the receiver signal level specification. If the received power is low, test the optical patch panel jumper. If the received power level is still too low, measure the transmitter. Refer to Table 4 "Fiber-optic transmit and receive signal levels" on page 33.

— Measure the transmitter power level using a good patch cable and the power meter. If the power is low, the problem is in the transmitter. If the transmitter output power level is within specifications, the fiber-optic link has to much signal attenuation.

— Check the optical patch panel. If attenuation in the patch panel is high, check the connections or splices in the patch panel.

— To check the fiber-optic link, you can start visual continuity check of the cable using a visual fault locator. This is usually the task of the fiber-optic link provider. Problems with the fiber-optic link may be caused by:

- cable cut or cable stress
- broken or damaged connectors
- bad splices

— If the cable is more than 500 meters long, you can use the OTDR to locate the fault in the fiber-optic link.

— If an optical connector is suspected, use a microscope to inspect the fibers and the ferrules in the connector.

Self-test

A self-test is automatically performed by each Superloop Network card and Peripheral Controller card connected to the Fiber Remote Multi-IPE Interface unit when you insert it into an operating system module, when you enable the card, or when you power up or reset the system. You can also perform a self-test on these cards using software commands.

The Fiber Remote Multi-IPE Interface unit also performs self-test upon power up.

This self-test checks general card functions and determines if they are operating correctly. Upon insertion, the card automatically starts self-test and it gives you an immediate indication of its operating status.

LED indicators

Meridian 1 cards are equipped with red LED indicators, and module power supplies are equipped with green LED indicators. These indicators show the status of each card and power supply.

The Fiber Remote Multi-IPE Interface unit provides LED indicators to show the power status and the alarm status of the Fiber Remote Multi-IPE Interface unit and the fiber-optic link.

The Fiber Remote Multi-IPE Interface unit activates a red alarm LED when a fault occurs at the near-end and at the same time it activates the yellow alarm LED on the corresponding Fiber Remote Multi-IPE Interface unit at the far-end. It also provides an amber LED to indicate the test and maintenance activity on the fiber-optic link. This amber LED will also light if the system alarms are disabled.

Display codes

The Peripheral Controller card in the Remote IPE is equipped with an alphanumeric display on the faceplate. The display is used to automatically display the card status and identify possible faults with the card by displaying specific codes that correspond to the card status. These codes are displayed in hexadecimal notation and are listed and interpreted in Appendix A of this manual and in section (HEX) in *X11 input/output guide (553-3001-311)*.

The display also indicates:

— It identifies the IPE controller, if the PSDL is successful

— Indicates current clock source or clock failure on superloops (on the controller card display)

These codes are also logged into a history file and can be printed and reviewed to analyze the sequence of events leading to the presently displayed status. The last 16 codes displayed by the Peripheral Controller card are stored in memory and can be reviewed and then cleared by using Network and Signaling Diagnostic Program LD 30.

Enable/disable switch

The Superloop Network card is equipped with an ENL/DIS switch. This ENL/DIS switch is located on the card's faceplate. It is used to disable the card before you remove it from an operating Meridian 1 system without disrupting other system functions. After you repair or replace the card, you can place it back in service by setting the switch to the ENL position.

System monitors and alarms

Meridian 1 system monitoring units continuously monitor the environmental and power status of the system and the individual system modules including the Remote IPE equipment.

The system monitor issues alarms when:

— CPU fails or system reloads

— main power source is lost

— power supply in the modules fails

— system temperature exceeds limits because of blower or fan failure

Meridian 1 alarms are based on the type and severity of faults reported by the system monitors and indicators. These alarms are divided into:

— major alarms, which indicate serious problems that require your immediate attention

— minor alarms, which indicate isolated faults relative to a limited number of call connection problems that do not require your immediate attention

The Fiber Remote Multi-IPE Interface unit issues a red alarm when a fault occurs at the near-end and at the same time it activates a yellow alarm on the corresponding Fiber Remote Multi-IPE Interface unit at the far-end.

Software diagnostic tools

Meridian 1 software diagnostic tools are used to monitor the system status, provide the ability to test various system functions and equipment suspected of being faulty, and log and display system fault history. These are:

— resident diagnostic programs

— interactive nonresident diagnostic programs

Resident programs

Meridian 1 resident programs are diagnostic and administration programs that continuously monitor system operation and report faults and generate system messages, which are displayed on the system terminal or printed on a system printer. These system messages are listed in *X11 input/output guide (553-3001-311).*

These messages are:

— maintenance display codes listed under HEX that indicate status and error conditions in the system

— maintenance messages listed under XMI are reported to the TTY that indicate status and faults with the Remote IPE equipment

— error messages listed under ERR that indicate hardware faults and under BUG that indicate software faults

— overload messages that indicate faulty peripheral cards listed under OVD

— error messages listed under PWR that indicate power faults

— fault history file that can be printed and reviewed to identify fault events leading to the present status

Resident administration programs provide automatic system administration routines that facilitate system initialization and fault recovery.

These are:

— overlay loader program that finds, loads, and executes all nonresident programs selected to run as midnight and background routines

— system loader program that downloads the call processing programs and starts checking main memory when executing sysload

— system initialization program that automatically starts after the system loader program completes the downloading process and outputs the initialization messages listed under INI in *X11 input/output guide (553-3001-311)*

Nonresident programs

Nonresident programs can be interactive or automatically executed programs. These programs are stored on the system hard disk or floppy disks and are loaded by the overlay loader program into system memory on demand or at a predetermined time of day such as for midnight and background routines testing.

You can access interactive programs through a maintenance terminal. These programs are used to:

— test the equipment and place lines and trunks out of service when testing or faulty and back into service when testing is completed or the line or trunk has been repaired or replaced

— verify the status of a fault

— verify that a fault has been corrected and the equipment is operating correctly

You can select a number of nonresident diagnostic programs by using Configuration Record Program LD 17. This is a program that selects other diagnostic programs and executes them automatically as midnight and background routines. These programs test the entire system and print a report that lists the test results.

You can also manually select continuity tests that check continuity between the Superloop Network card in Meridian 1 and the Peripheral Controller card in the Remote IPE module, as well as other network and peripheral cards. You can specify these tests in Background Signaling and Switching program LD 45. BSD messages indicate the status of the network continuity tests and other network problems.

Superloop and Controller cards maintenance commands

The maintenance commands for the Superloop Network card and Peripheral Controller cards are used to manipulate the operational status and perform diagnostic tests on these cards. These commands are located in Network and PE Diagnostic LD 32, which can be accessed using the administration terminal or the MMI terminal used in the Host SDI mode.

Table 17 lists superloop maintenance commands provided by Network and PE Replacement Diagnostic LD 32. NPR000 are diagnostic messages displayed to indicate the status of the equipment.

Table 17
Meridian 1 network superloop maintenance commands

Maintenance command	Maintenance command description
DISL loop	Disables network loop
ENLL loop	Enables network loop
DISS l s	Disables a shelf or module
ENLS l s	Enables a shelf or module
DSXP x	Disables Peripheral Controller and all IPE cards
ENXP x	Enables Peripheral Controller and all IPE cards
ENXP XPEC x	Enables Peripheral Controller but not IPE cards
STAT loop	Displays status for one or all network loops
SUPL loop	Prints data for one or all superloops. Maps from superloop number to IPE controller number.
XNTT loop	Self-test on a Network card for a specific loop
XPCT x	Self-test on Peripheral Controller x
XPEC x	Prints data for Peripheral Controller x. Maps from IPE controller number to superloop number.
IDC	Test Card-LAN operation and queries superloop, peripheral controller, and IPE cards. Returns part numbers and serial numbers of cards.

Remote IPE MMI maintenance commands

The Fiber Remote Multi-IPE Interface unit provide a man-machine interface (MMI) port to connect a configuration and maintenance terminal. Through this terminal, you can directly issue commands to the Fiber Remote Multi-IPE Interface to test the Fiber Remote Multi-IPE Interface unit, the superloops connected to the unit, and the fiber-optic link.

The MMI terminal can also be used to configure, maintain, and test the Meridian 1 system when placed in the Host SDI mode.

Table 18 lists all MMI commands that are used to configure, maintain, and test the Fiber Remote Multi-IPE Interface associated superloops and the fiber-optic link.

Table 18
MMI commands (Part 1 of 3)

Command	Description
A D	Alarm disable. Disables all alarms.
A E	Alarm enable. Enables all alarms.
C A	Clear alarm. Clears all alarms and resets the fiber-optic link bit error rate counters.
C A L	Clear alarm log. Clears near-end fiber link alarm log.
C A L D	Clear alarm log. Clears far-end fiber link alarm log.
C E	Clear error log. Clears near-end fiber link error log.
C E D	Clear error log. Clears far-end fiber link error log.
D A [P]	Display alarms [Pause]. Displays the alarm log for the near-end. It contains the previous minute and the most recent 100 alarms logged with time and date stamp.
D A D	Display alarms. Displays the alarm log for the far-end. It contains the previous minute and the most recent 100 alarms logged with time and date stamp.

Table 18
MMI commands (Part 2 of 3)

Command	Description
D C [P]	Display configuration [Pause]. Displays current near-end configuration such as time, date, name, and link bit error threshold.
D C D	Display configuration. Displays current far-end configuration such as time, date, name, and link bit error threshold.
D E [P]	Display error [Pause]. Displays near-end error log, which contains the previous minute and the last 30 days of the fiber-optic link error statistics.
D E D	Display error. Displays far-end error log, which contains the previous minute and the last 30 days of the fiber-optic link error statistics.
D S [P]	Display status [Pause]. Displays near-end superloop and fiber-optic link status.
D S D	Display status distant. Displays far-end superloop and fiber-optic link status.
H or ?	Help. Displays the help screen.
HOST or HO	Connects the MMI terminal to the SDI port. The password is **HOST**.
L	Logs into the MMI terminal for one Fiber Remote Multi-IPE Interface. The password is **FIBER**.
L xx	Logs into a specific superloop when the system has more than one Fiber Remote Multi-IPE Interface connected in a daisy-chain, where xx is the Fiber Remote Multi-IPE Interface address in the chain. The password is also **FIBER**.
Q	Logs the terminal user out.
S A	Sets the fiber-optic link bit errors per minute alarm threshold in the range from 10^{-10} to 10^{-6}.

Table 18
MMI commands (Part 3 of 3)

Command	Description
S C	Sets alarm self-clearing function to either "enable" or "disable".
S D	Sets date or verify current date.
S L	Set link. Configures which fiber-optic link (A or B) is selected to transmit data, for a redundant link.
S N	Set name. Sets the name for the site and superloops. The site name can be 9 characters long and the superloop name can be 5 characters long. These names are shown in the Display Status screen.
S T	Sets time or verifies current time.
T A	Test all. Initiates a series of pre-programmed tests on the near and far-end superloops and fiber-optic links. Test duration can be set from 1 to 98 minutes. By entering 0, the tests run one time. To stop testing enter **STOP**.
T FI	Test fiber. Initiates a series of pre-programmed tests on the fiber-optic links. Test duration can be set from 1 to 98 minutes. By entering 0, the tests run one time. To stop testing enter **STOP**.
T SL	Test near-end superloop. Initiates a series of pre-programmed tests on the near-end superloops. Test duration can be set from 1 to 98 minutes. By entering 0, the tests run one time. To stop testing enter **STOP**.
T SL D	Test far-end superloop. Initiates a series of pre-programmed tests on the far-end superloops. Test duration can be set from 1 to 98 minutes. By entering 0, the tests run one time. To stop testing enter **STOP**.
@@@	Terminates the Host SDI mode and returns the terminal to the MMI mode.

Background diagnostics

The Fiber Remote Multi-IPE Interface MPU continuously monitors the Fiber Remote Multi-IPE Interface functions, the fiber-optic link performance, and the superloop status.

If the Fiber Remote Multi-IPE Interface MPU detects loss of clock, loss of frame, loss of signal, or excessive bit error rate, the following alarm conditions are exhibited:

— The normally open alarm contacts are closed at both ends of the link.

— The red alarm LED is lit at the near-end of the fault and a yellow alarm LED is simultaneously lit at the far-end of the fiber-optic link.

— The MMI maintenance terminal displays the error report and the printer, if equipped, prints the error report.

— The alarm log file is updated with the latest error condition.

— The system monitor reporting is interrupted for one second.

Off-line and on-line diagnostics

Off-line diagnostic tests are potentially traffic affecting if they are performed on an active superloop that has to be disabled or an active superloop is tested by mistake. Normally the tests are performed on disabled superloops. Therefore, before you can test a superloop, you must disable that superloop using overlay programs LD 32. These tests are more extensive than background tests, even though they also test for loss of clock, loss of frame, loss of signal, and excessive bit error rate on the fiber-optic link.

On-line diagnostic test are performed with the Microlink up and are not traffic affecting. If the Microlink is down, the system assumes that there is a loopback condition.

The off-line commands are:

— TEST SUPERLOOP (T SL). Tests a specified near-end superloop.

— TEST SUPERLOOP DISTANT (T SL D). Tests a specified far-end superloop.

— TEST FIBER (T FI). Tests near-end Fiber Remote Multi-IPE Interface, the fiber-optic link, and the far-end Fiber Remote Multi-IPE Interface.

— TEST ALL (T A). Tests all the functions tested by the above two test commands.

On-line diagnostic tests:

The on-line diagnostic test are conducted with the Microlink up and are not traffic affecting. Such a test is TEST FIBER (T FI). It tests near-end Fiber Remote Multi-IPE Interface, the fiber-optic link, and the far-end Fiber Remote Multi-IPE Interface. This test may become traffic affecting if during the test the redundant fiber-optic link fails.

Isolating and correcting faults

Now that you are familiar with the troubleshooting tools, you can begin troubleshooting the Fiber Remote Multi-IPE Interface units and Remote IPE equipment. Based on whether Remote IPE equipment has just been installed and is not yet operational or it had been operating correctly and is now faulty, you can determine what may be the most probable cause of failure.

Types of faults

Problems can occur in the following areas:

— Hardware

— Configuration

— Software

The types of faults you must isolate and correct depend on when the faults occur during installation or in a previously operating system. For example, in a newly installed system, the fault may be in any or all of the three areas; however, in a previously operating system, the fault will probably be in the hardware.

Fault isolation steps

The following steps show you how to isolate Remote IPE faults using the diagnostic tools described in this chapter:

1 Observe and list the problem symptoms the system is exhibiting. Typical symptoms can include the: Superloop Network card or Peripheral Controller cards LEDs are ON, the Peripheral Controller card faceplate display showing a fault code, or the Fiber Remote Multi-IPE Interface LEDs indicating no transmission on the fiber-optic link.

2 Note whether Remote IPE was just installed and has not been operating, or if it has been operating correctly and is now faulty. Based on this, refer to "Newly installed Remote IPE" on page 135 or "Previously operating Remote IPE" on page 136 for lists of the most common problems.

3 Take the action recommended by the fault isolation and correction tables, which will guide you through fault isolation steps and recommend what test procedures to use.

4 If after following the diagnostic procedures the Remote IPE still does not operate correctly, contact your field service representative.

Newly installed Remote IPE

Problems that occur during the installation of an entire system, including the Remote IPE, are usually caused by:

— improperly installed cards

— loose or improperly connected external communication cables, or fiber-optic link cables

— incorrect Remote IPE configuration (local versus remote)

These types of problems may also occur when:

— installing additional Remote IPE equipment into an already operating system

— installing a new software version or changing Remote IPE configuration

Check the symptoms listed in Table 19 that are related to problems with a newly installed Remote IPE.

Previously operating Remote IPE

Problems that occur during the normal operation of Remote IPE are usually caused by:

— faulty equipment

— accidental disconnection of cables

— improper environmental conditions

Check the symptoms also listed in Table 19 that are related to problems with a previously operating Remote IPE.

Remote IPE fault isolation and correction

Fault isolation and correction of Remote IPE equipment encompasses the Superloop Network cards and Peripheral Controller cards that support the fiber-optic link, and the Fiber Remote Multi-IPE Interface units at each end of the link.

Table 19 refers you to the test procedures in this manual that will most likely be able to resolve the problem based on the symptoms you observe.

Table 19
Meridian 1 Remote IPE equipment problems (Part 1 of 2)

Symptoms	Diagnosis	Solution
Red LED on the Superloop Network card or Peripheral Controller card permanently on.	Card is disabled or faulty.	Go to *Procedures 1, 2, or 3* and *4* in this chapter to check the card status and perform self-test.
Power LED on the Fiber Remote Multi-IPE Interface unit is off.	Power is not supplied to the Fiber Remote Multi-IPE Interface unit or the unit failed self-test upon power up.	Check the AC/DC converter and the connections to the Fiber Remote Multi-IPE Interface unit and the AC outlet on the wall. If powered directly from a DC source, check the source and the connection to the unit. If the power is present, the Fiber Remote Multi-IPE Interface unit is faulty. Replace it.

Table 19
Meridian 1 Remote IPE equipment problems (Part 2 of 2)

Symptoms	Diagnosis	Solution
Yellow Alarm LED on the Fiber Remote Multi-IPE Interface on.	Far-end is in red alarm state and there is no communication over the link.	Check fiber-optic link connections and go to *Procedure 6* to display the status. Then go to *Procedure 7* to test the superloop and the fiber-optic link.
Red Alarm LEDs on the Fiber Remote Multi-IPE Interface on.	Near-end Fiber Remote Multi-IPE Interface unit or fiber-optic link faulty.	Check fiber-optic link connections and go to *Procedure 6* to display the status. Then go to *Procedure 7* and *Procedure 8* to test the equipment.
Both red and yellow Alarm LEDs are on the Fiber Remote Multi-IPE Interface.	Fiber-optic link is faulty.	Check the link cable connections to the Fiber Remote Multi-IPE Interface unit. Go to *Procedure 7* and *Procedure 9* to test the fiber-optic link.
Amber Maintenance LED is on.	Alarms are disabled or off-line diagnostic test is in progress.	Enable the alarms, if disabled. Wait for the test to complete and analyze the results of the test. Otherwise terminate the off-line test by entering **S** (stop) command at the MMI terminal.
Link is OK but no communication with the system monitor.	System monitor address incorrect.	Define a unique address correctly. Observe the XMI messages on the MMI terminal and check the description of these messages listed in Also refer to *X11 input/output guide (553-3001-311)* Use this information to locate and correct the fault.
Display on the Peripheral Controller card shows fault codes.	Card faulty. Failed self-test or problem communicating with peripheral equipment.	Go to *Procedures 3*, *4* and *8* to check tracking and loopback. Also refer to *Appendix A*. for a list of codes. Based on the test results and maintenance display codes description, take the appropriate action and resolve the problem.
Error messages displayed on the MMI terminal or printed on the Meridian 1 TTY.	Hardware or software problems with the Remote IPE.	Note various error messages. Refer to *X11 input/output guide (553-3001-311)* for a list of these messages and their description. Based on the code's description, take the appropriate action to resolve the problem.

If you cannot resolve the problem after exhausting all available diagnostic tools and test procedures, make a list of the symptoms and contact your field service representative.

Superloop Network card fault isolation and correction

The Superloop Network card provides a communication interface between the CPU in Meridian 1 and the Peripheral Controller card in the Remote IPE.

The Superloop Network card processes signaling information and data received from the Peripheral Controller card over the fiber-optic link.

Problems with the Superloop Network card may be caused by hardware faults, incorrect configuration, a disabled Superloop Network card, or continuity problems between the card and other network cards connected to the network bus. To isolate and correct problems with the Superloop Network card, follow the procedures below.

Procedure 1
Checking the status of the Superloop Network card

The diagnosis in Table 19 indicates that the Superloop Network card may be faulty or disabled. The first step in identifying the problem is to verify the status of the Superloop Network card. The status of a Superloop Network card is obtained by executing the **STAT sl** command in Network and Signaling Diagnostic Program LD 30.

To obtain the Superloop Network card status:

1 Log in on the MMI maintenance terminal, first as **FIBER** to get into the MMI mode, and then login as **HOST** to get into the Host SDI mode.

Note: If you entered the **HO** command while someone else is active in the Host SDI mode, the system will not allow you to log in and it will display on your terminal "CONN DENIED".

2 At the **>** prompt, type **LD 30** and press the Enter key to access the Network and Signaling Diagnostic Program LD 30.

3 Type **STAT sl** and press the Enter key, where **sl** is the superloop number of the Superloop Network card you are testing.

4 If the response is UNEQ = then the superloop is not equipped (the Superloop Network card is not installed).

5 If the Superloop Network card is manually disabled using LD 30, the response can be:

DSBL: NOT RESPONDING = the loop is disabled and the card is not responding (the card is missing, disabled by the EBL/DIS switch, or faulty).

DSBL: RESPONDING = the loop is disabled and the card is responding (the card is disabled with DISL command, the Peripheral Signaling card is disabled, or an overload condition exists).

Note: Overload conditions are indicated by OVDxxx messages. Refer to *X11 input/output guide (553-3001-311)* for the message description and indication of the problem.

x BUSY, y DSBL = the loop is enabled with x channels busy and y channels disabled.

CTYF L1 L2... = loop specified in STAT command cannot receive speech from one or more loops or there is a possible continuity test failure due to a faulty network card such as the Superloop Network card.

Type **ENLL sl** and press the Enter key to enable the superloop, where **sl** is the Superloop Network card superloop number. A message indicating that the Superloop Network card is enabled and working is displayed on the console. Also observe the red LED on the Superloop Network card. If it turns off, the Superloop Network card is functioning correctly. If the LED continues to stay on, the Superloop Network card probably failed self-test and a message should be displayed on the maintenance terminal to that effect.

If the message indicates that the Superloop Network card is faulty, replace the card.

Procedure 2
Performing the Superloop Network card self-test

If the Superloop Network card appears faulty, you should conduct the self-test to verify that it is actually faulty before you replace it. This test verifies the basic Superloop Network card functions and outputs a fail or pass message after the test is completed.

To perform the self-test, follow the steps below:

1 Log in on the maintenance terminal as Host SDI.

2 At the > prompt, type **LD 32** and press the Enter key to access the Network and PE Diagnostic Program LD 32.

3 Type **DISL sl** and press the Enter key to disable the Superloop Network card, where **sl** is the Superloop Network card loop number you are disabling.

4 Type **XNTT sl** and press the Enter key to start the self-test, where **sl** is the Superloop Network superloop number specified for self-test.

If the response is:

TEST PASSED

The Superloop Network card passed the self-test and is functional; it must be enabled to turn off the red LED and to start processing calls.

If the Superloop Network card passed the self-test, but the problem persists, the loop or other cards that interface with the Superloop Network card may be faulty. To verify the integrity of the network bus and connections between the Superloop Network card and other network and peripheral equipment cards interfacing with the Superloop Network card, go to Procedure 3.

If the response is

TEST FAILED REASON: xxxx

XPEC NOT CONNECTED

The Superloop Network card failed the self-test and is faulty, where **xxxx** can be one of the following values:

0--ROM checksum failed
1–FLASH checksum failed
2–A21 #1 faulty
3–A21 #2 faulty
4–R71 faulty
Replace the Superloop Network card as described in Replacement procedures. NPRxxx message may be displayed as a result of a command activated self-test if the Superloop Network card is missing, not configured, and so on.

5 Exit LD 32 by typing **....** at the prompt.

Peripheral Controller card fault isolation and correction

The Peripheral Controller card provides a communication interface between the Superloop Network card and the IPE cards housed in the Remote IPE module.

Problems with the Peripheral Controller card may be caused by hardware faults, incorrect configuration, a disabled Peripheral Controller card, or continuity problems between the card and IPE cards connected to the peripheral bus. To isolate and correct problems related to the Peripheral Controller card, follow the procedures below.

Procedure 3:
Checking the Peripheral Controller card tracking status

The Peripheral Controller card can display tracking information, which shows the status of the Peripheral Controller card phase-lock loop and to what clock source it is locked. To obtain this information, execute the **RPED l s** command in Network and Signaling Diagnostic Program LD 30.

To obtain the Peripheral Controller card tracking status:

1 Log in on the maintenance terminal as Host SDI.

2 At the > prompt, type **LD 30** and press the Enter key to access the Network and Signaling Diagnostic Program LD 30.

3 Type **RPED l s** and press the Enter key, where l is the loop number of the Superloop Network card and **s** is the shelf or module you are testing.

The Peripheral Controller card may return one of the following codes:

C0—Controller is locked on the network superloop connected to SL0

C1—Controller is locked on the network superloop connected to SL1

C2—Controller is locked on the network superloop connected to SL2

C3—Controller is locked on the network superloop connected to SL3

CF—Controller is not locked on any network superloop

4 Exit LD 30 by typing **....** at the prompt.

5 Check the incoming signal. If present, replace the Controller; otherwise, find the problem on the link or the Fiber Remote Multi-IPE Interface unit.

Procedure 4
Performing the Peripheral Controller card self-test

If the Peripheral Controller card appears faulty, you should conduct the self-test to verify that it is actually faulty before you replace it. This test verifies the basic Peripheral Controller card functions and outputs a fail or pass message after the test is completed. During self-test the Peripheral Controller card displays HEX messages indicating the test performed. To identify the codes displayed, refer to Table 20, "Peripheral Controller self-test HEX codes," on page 162.

To perform the self-test, follow the steps below:

1 Log in on the maintenance terminal as Host SDI by entering the password **HOST** from the MMI mode.

Note: If you entered the **HO** command while someone else is active in the Host SDI mode, the system will not allow you to log in and it will display on your terminal "CONN DENIED".

2 At the **>** prompt, type **LD 32** and press the Enter key to access the Network and PE Diagnostic Program LD 32.

3 Type **DSXP x** and press the Enter key to disable the Peripheral Controller card, where **x** is the Peripheral Controller card you are disabling.

4 Type **XPCT x** and press the Enter key to start the self-test, where **x** is the Peripheral Controller card specified for self-test.

If the response is:

TEST PASSED

The Peripheral Controller card passed the self-test and is functional. It must be enabled to turn off the red LED and start processing calls.

Type **ENXP x** and press the Enter key to enable the card.

If the Peripheral Controller card passed the self-test, but the problem persists, the Fiber Remote Multi-IPE Interface, the fiber-optic link, or other cards that interface with the Peripheral Controller card may be faulty.

If the response is:

TEST FAILED REASON: xxxx

The Peripheral Controller card failed the self-test and is faulty, where **xxxx** specifies the cause of the fault. An NPRxxx message may be displayed as a result of a command activated self-test if the Peripheral Controller card is missing, not configured, and so on.

5 Exit LD 32 by typing ******** at the prompt.

Fault isolation and correction using MMI maintenance commands

You can perform testing and troubleshooting of the Fiber Remote Multi-IPE Interface units and Remote IPEs from a local or a remote MMI terminal by typing MMI commands on the terminal without loading system diagnostic programs (overlays).

These commands provide current equipment status, perform superloop and link testing, check equipment performance, print messages from log files, and clear alarm and error logs.

Procedure 5
Display alarm and error logs to check the performance history

Display Alarm:

This procedure uses MMI commands to display the superloop and the fiber-optic link performance history.

1 Log in on the MMI maintenance terminal.:

FII:: >L	Login command
Enter Password > **FIBER**	Type in the password.

2 Type **D A [P]** (DISPLAY ALARM) to display near-end superloop and fiber-optic link alarm history. Type **D A D** (DISPLAY ALARM DISTANT) to display far-end superloop and link alarm history. The **[P]** or pause, allows you to display a full screen of events at the time.

The response is displayed on the screen and shows the time and date, of each alarm or error event.

Example:

FII::>D A
Fiber Remote IPE S/N 2502-R3 Software Version 3.11 5/15/96 10:45
Local Site
In Alarm State: NO (superloops are not in the alarm state)

01/22/96 09:26 No Activity Superloop 1
01/22/96 09:26 Activity On Superloop 1
01/22/96 09:25 No Activity Superloop 1
01/22/96 09:25 Activity On Superloop 1
01/22/96 09:24 No Activity Superloop 4
01/22/96 09:20 No Activity Superloop 3
01/22/96 09:17 Activity On Superloop 4
01/22/96 09:17 Activity On Superloop 3
01/22/96 09:17 Activity On Superloop 2
01/22/96 09:17 Fiber Link Up
01/22/96 09:16 Fiber A Threshold Exceeded
01/22/96 09:16 Fiber Link Down
01/22/96 09:15 Performed a Power Up Reset
01/22/96 09:15 Initialized Memory
01/22/96 09:10 Log Cleared

You can clear the near-end (local) alarm log by executing the **C AL** (CLEAR ALARM) and the far-end (remote) by executing the **C AL D**

(CLEAR ALARM DISTANT) command.

3 Type **D E [P]** (DISPLAY ERROR) to display near-end superloop and fiber-optic link error history. Type **D E D** (DISPLAY ERROR DISTANT) to display far-end superloop and fiber-optic link error history. The **[P]** or pause, allows you to display a full screen of events at the time.

The log file contains 30 days of error statistics. During each midnight routine, the file stores the highest error rate minute detected in the last 24 hours and time and date when it occurred. If the redundant link is present, the error statistics of both links will be displayed. The response is displayed on the screen as follows:

Example:

FII::>D E
Fiber Remote IPE S/N 2502 Software Version 3.11 5/15/96 10:45
Local Site
In Alarm State: NO (superloops are not in the alarm state)

You can clear the near-end (local) error log by executing the **C E** (CLEAR ERROR) and the far-end (remote) by executing the **C E D** (CLEAR ERROR DISTANT) command.

Procedure 6
Checking the superloop and the fiber-optic link status

This procedure uses MMI commands to display the superloop and the fiber-optic link status.

To obtain the superloop and link status:

1 Log in on the MMI maintenance terminal:

FII:: >L	Login command
Enter Password > **FIBER**	Type in the password.

2 Type **D S** (DISPLAY STAUTS) to display near-end superloop and fiber-optic link status. Type **D S D** (DISPLAY STATUS DISTANT) to display far-end status.

The response is displayed on the screen and shows the software version, present time and date, alarm status, error rate, and the superloop link status.

Example:

FII::>D S
Fiber Remote IPE S/N 25002-R3 Software Version 2.05 04/15/96 9:25
Local Site
In Alarm State: NO (superloops are not in the alarm state)

Fiber A Threshold Alarm Active: NO
Error Rate: E-99 Today's Max: 04/15/96 9:25 Error Rate: E-6

Superloop Link 1 ALARM MODE Superloop Link 2 NORMAL
Superloop Link 3 INACTIVE Superloop Link 4 NORMAL

The Error Rate: E-99 indicates no error have been detected
The Error Rate: E-0 indicates that no signal has been detected

The superloop can be in:

- Alarm mode when a fault is detected
- Inactive mode when the superloop cable is not installed
- Normal (active) mode when the superloop is operating correctly

3 Analyze the response and determine where the problem may be, if any. If the near-end superloop is faulty, the problem may be in the superloop cables, the Superloop Network card, or the Fiber Remote Multi-IPE Interface unit. Visually check each component and correct the problem. Otherwise go to Procedure 8 "Testing the superloop" on page 150.

4 If the D S D command shows problem with far-end communication, the problem may be in the fiber-optic link, link connectors, or the far-end Fiber Remote Multi-IPE Interface. Go to Procedure 7 "Testing the superloops and the fiber-optic link" below.

Procedure 7
Testing the superloops and the fiber-optic link

This procedure uses the MMI commands to test all superloops and fiber-optic links. To perform these tests, execute the (TEST ALL) **T A** command. This test will interfere with normal traffic, therefore all superloops should be disabled.

1 To disable all superloops, you wish to test, place the MMI terminal into the Host SDI mode:

FII::>HO
Enter Password:> HOST (all caps)

2 At the prompt type **LD 32** and press the Enter key to access the overlay. Then execute the **DISL sl** command for each superloop, where **sl** is the superloop number.

3 Now you have to place the MMI terminal into the MMI mode by entering @@@.

4 To test the disabled superloop and the fiber-optic link, execute the **T A** command at the MMI terminal. You have the option of running the test once by typing **0** or you can run the test for a number of minutes from **1** to **98** by typing the number of minutes. By typing **99**, the test will run continuously until stopped. You can stop the test by typing **S.**

Example:

FII::>T A
Enter Duration of Test (1-98 Mins, 0= Once, 99= Forever)
Verify Super Loops are Disabled. Hit Q to quit or any Key to Cont

Link 1 PASSED
Link 2 PASSED
Link 3 PASSED
Link 4 PASSED
Link 5 PASSED
Link 6 PASSED
Link 7 PASSED
Link 8 PASSED
DS-30 Link Test Completed

DS-30A Frame 1 PASSED
DS-30A Frame 2 PASSED
DS-30A Frame Test Completed

DS-30A Clock 1 PASSED
DS-30A Clock 2 PASSED
DS-30A Clock Test Completed

Test Fiber A
Micro Link Up. Test Using Distant Loopback
Fiber Message Test Passed
Fiber Test Completed
All Tests Completed. All Tests Passed.

5 Analyze the response and determine where the problem may be, if any. If the superloop is faulty, the problem may be in the superloop cables, the Meridian 1 card (Superloop Network or Peripheral Controller card), or the Fiber Remote Multi-IPE Interface unit.
Go to Procedure 8 to troubleshoot the superloop problems.
Go to Procedure 9 to troubleshoot the fiber-optic link problems.

6 After the test has been completed, return the terminal in the Host SDI mode and enable each disabled superloop by executing the **ENLL sl** command in LD 32.

Procedure 8
Testing the superloop

This procedure uses the MMI commands to test a superloop connected to the near-end or the far-end Fiber Remote Multi-IPE Interface units.

To test a near-end superloop, execute the (TEST SUPERLOOP) **T SL** command.

To test a far-end superloop, execute the (TEST SUPERLOOP DISTANT) **T SL D** command.

1 Before you can start the test, you must disable the superloop you wish to test by placing the MMI terminal into the Host SDI mode:

FII::>HO
Enter Password:> HOST)

2 At the prompt type LD 32 and press the Enter key to access the overlay. Then execute the **DISL sl** command to disable the superloop **sl.**

3 Now you have to place the MMI terminal into the MMI mode by entering **@@@**.

4 To test the disabled near-end superloop, execute the **T SL** command at the MMI terminal.

5 To test the disabled far-end superloop, execute the **T SL D** command at the MMI terminal. You have the option of running the test once by typing **0** or you can run the test for a number of minutes from **1** to **98** by typing a number that represents minutes. By typing **99**, the test will run continuously until stopped. You can stop the test by typing **S.**

Example:

```
FII::>T SL
Enter Super Loops to Test (1-4) 1
Enter Duration of Test (1-98 Mins, 0= Once, 99= Forever)
Verify Super Loops are Disabled. Hit Q to quit or any Key to Cont
Testing Super Loop 1
Link 1 PASSED
Link 2 PASSED
Link 3 PASSED
Link 4 PASSED
DS-30 Link Test Completed

DS-30A Frame 1 PASSED
DS-30A Frame Test Completed

DS-30A Clock 1 PASSED
DS-30A Clock Test Completed
Super Loop 1 PASSED
Test Summary
Super Loop 1 PASSED)
```

6 If the test shows problems with superloops, check the superloop cable connections, the Fiber Remote Multi-IPE Interface, and the Meridian 1 cards (Superloop Network and Peripheral Controller card). Check each component and replace the faulty one. Execute the T SL and T SL D commands until the status shows problem free operation.

7 After the test has been completed, return the terminal in the Host SDI mode and execute the **ENLL sl** command in LD 32.

Procedure 9
Testing the fiber-optic link

This procedure tests the Fiber Remote Multi-IPE Interface at both ends of the link and the fiber-optic link itself. If a redundant link is configured, this test will check both links.

This test will interfere with normal traffic, therefore all superloops should be disabled.

1 To disable all superloops, place the MMI terminal into the Host SDI mode:

FII::>HO
Enter Password:> HOST)

2 At the prompt type **LD 32** and press the Enter key to access the overlay. Then execute the **DISL sl** command for each superloop, where **sl** is the superloop number you are disabling.

3 Now you have to place the MMI terminal into the MMI mode by entering **@@@**.

4 To test the fiber-optic link, execute the (TEST FIBER) **T FI** command at the MMI terminal.You have the option of running the test once by typing **0** or you can run the test for a number of minutes from **1** to **98** by typing the number of minutes. By typing **99**, the test will run continuously until stopped.You can stop the test by typing **S.**

Example:

FII::>T FI
Enter Duration of Test (1-98 Mins, 0= Once, 99= Forever)
Test May Interfere with XSM Traffic. Hit Q to quit or any Key to Cont
Test Fiber A
Micro Link Up. Test Using Distant Loopback
Fiber Message Test Passed
Fiber Test Completed

(after introducing a fault in the link)
Fiber A Threshold Exceeded
Fiber Link Down
Distant-Fiber A Threshold Exceeded
Fiber Link Restored (after correcting the fault)
Distant-No Activity Super Loop 1
Distant-Activity On Super Loop 1

5 If the test results shows problem with communication across the fiber-optic link, the problem may be in the fiber-optic link, link connectors, or the far-end Fiber Remote Multi-IPE Interface.

6 Check the fiber-optic cables and optical connectors to verify that they are properly connected.

7 Execute **T FI** command again to check if the problem still exists.

8 If the problem persists, disconnect the fiber-optic link from the Fiber Remote Multi-IPE Interface optical connectors and install the appropriate attenuated fiber-optic patchcord into the RCV and XMIT optical connectors on the faceplate to create a loopback.

9 Execute **T FI** command again to check if the problem still exists. If the problem still exists, replace the Fiber Remote Multi-IPE Interface unit.

10 If the problem is not detected, the problem must be in the fiber-optic link.

11 Connect an optical power meter to the RCV connector on the link and measure the received signal power. If the power is between -30dBm and -8 dBm, the signal is being received from the far-end.

12 If no signal is detected, check the fiber-optic link and ST optical connectors. Check the splices and clean the connectors.

CAUTION

Keep the optical connectors absolutely clean. Use pure isopropyl lint-free wipes to clean the ferrule part of the optical connector and aerosol duster to blow out dust particles from the adapter part of the optical connector.

Make sure that the ferrules in the optical connectors are properly installed and aligned in their respective adapters. This is particularly critical for the single-mode fibers where tolerances are tighter.

13 To verify the integrity of the fiber-optic link, use a light source at one end of the link and the power meter at the other to measure the attenuation in the link and thus determine if each branch of the link is meeting the expected signal attenuation. If not, the link problem has to be corrected.

14 If the problem with the fiber-optic link has been corrected, reinstall the link connectors into the Fiber Remote Multi-IPE Interface ST faceplate connectors and execute the **T FI** command again.

15 If the problem still exists, repeat steps 8 and 9 at the far-end.

16 If the problem is finally corrected, execute the **T A** command as described in Procedure 7 to test the link and superloops again and verify that all the problems have been corrected.

17 After the test has been completed, return the terminal in the Host SDI mode and enable each disabled superloops by executing the **ENLL sl** command in LD 32.

Replacing Remote IPE equipment

If after completing troubleshooting you determine that one or more Remote IPE cards or the Fiber Remote Multi-IPE Interfaces are defective, you will have to remove them and replace them with spares. When you insert a spare Superloop Network card or Peripheral Controller card in the module, observe the card LED to determine if the card passed self-test. Package and ship the defective cards to an authorized repair center.

Unpacking replacement equipment

Unpack and visually inspect replacement equipment as follows:

1. Inspect the shipping container for damage. Notify your distributor if you find that the container is damaged.
2. Remove the unit carefully from the container. Do not puncture or tear the container—use a utility knife to open it. Save the container and the packing material for shipping the defective card.
3. Visually inspect the replacement equipment for obvious faults or damage. Report the damage to your sales representative.
4. Keep cards in their antistatic bags until you are ready to install them. Do not stack them on top of each other.
5. Install cards. When handling the cards, hold them by their nonconducting edges to prevent damage caused by static discharge.

Removing and replacing a card

A Remote IPE card can be removed from and inserted into a Meridian 1 module or the Remote IPE module without turning off the power to the module. This feature allows Meridianþ1 to continue normal operation when you are replacing a Superloop Network card in Meridian 1 or a Peripheral Controller card in the Remote IPE module.

Removing and replacing a Superloop Network card

1 Disable the Superloop Network card by logging in to the system terminal, loading the Network and Peripheral Equipment Diagnostic Program LD 32, and executing **DIS sl**, where **sl** is the actual loop number of the Superloop Network card.

2 Set the ENL/DIS switch to DIS.

3 Disconnect the card faceplate cables.

4 Unlatch the card's locking devices by squeezing the tabs and pulling the upper locking device away from the card and pressing the lower locking device downward.

5 Pull the card out of the network module and place it into an antistatic bag away from the work area.

6 Set the replacement card ENL/DIS switch to DIS.

7 Hold the replacement card by the card locking devices and insert it partially into the card guides in the module.

8 Pull the upper and lower locking device away from the faceplate and insert the card firmly into the backplane connector. Press the upper and lower locking devices firmly against the faceplate to latch the card inside the module.

9 Set the ENL/DIS switch on the Superloop Network card to ENL. The Superloop Network card automatically starts the self-test.

10 Observe the red LED on the front panel during self-test. If it flashes three times and stays on, it has passed the test; go on to step 12. If it does not flash three times and then stays on, it has failed the test. Pull the card partially out of the module and reinsert it firmly into the module. If the problem persists, troubleshoot or replace the Superloop Network card.

11 Connect the I/O panel cables to the J1 and J2 faceplate connectors of Superloop Network card.

12 Set the ENL/DIS switch to ENL. If the red LED on the Superloop Network card faceplate turns off, the card is functioning correctly and is enabled. The outcome of self-test will also be indicated on the system terminal or TTY (or the MMI terminal connected to the Fiber Remote Multi-IPE Interface MAINT connector). If the LED stays on, go to "Isolating and correcting faults" on page 134 in this document.

13 Tag the defective card(s) with a description of the problem and prepare them for shipment to your equipment supplier's repair depot.

Removing and replacing a Peripheral Controller card

1 Log in on the TTY or the MMI maintenance terminal.

2 At the > prompt, type **LD 32** and press the Enter key to access the program.

3 Type **DSXP x**, where **x** is the Peripheral Controller card, and press the Enter key to disable the card. The Peripheral Controller card is now disabled and you can remove it.

4 Unlatch the card's locking devices by squeezing the tabs and pulling the upper and lower locking devices away from the card.

5 Pull the card out of the Remote IPE module and place it in an antistatic bag away from the work area.

6 Hold the replacement card by the card locking devices and insert it partially into the card guides in the module.

7 Pull the upper and lower locking devices away from the faceplate on the card and insert the card firmly into the backplane connector. Press the locking devices firmly against the faceplate to latch the card inside the module. The Peripheral Controller card automatically starts the self-test.

8 Observe the red LED on the front panel during self-test. If it flashes three times and stays on, it has passed the test. If it does not flash three times and then stays on, it has failed the test. Pull the card partially out of the module and reinsert it firmly into the module. If the problem persists, troubleshoot or replace the Peripheral Controller card.

9 At the prompt in the LD 32 program, type **ENXP x**, where **x** is the Peripheral Controller card, and press the Enter key to enable the card. If the red LED on the Peripheral Controller card faceplate turns off, the card is functioning correctly and is enabled. The outcome of self-test will also be indicated by LD 32 on the MMI terminal connected to the Peripheral Controller card. If the LED stays on, replace the card.

10 Tag the defective card(s) with a description of the problem and prepare them for shipment to your equipment supplier's repair depot.

Removing and replacing a complete Fiber Remote Multi-IPE Interface unit

Note: Replace only the card, unless the Fiber Remote Multi-IPE Interface unit enclosure is also faulty, then you should replace the entire unit.

When replacing the Fiber Remote Multi-IPE Interface, you can replace the entire unit or just the card (motherboard with faceplate combination). The following procedure replaces the entire unit:

1 Log in on the TTY or the MMI maintenance terminal.

2 Disable the Superloop Network card by loading the Network and Peripheral Equipment Diagnostic Program LD 32, and executing **DIS sl**, where **sl** is the actual superloop number of the Superloop Network card.

3 Disconnect the AC/DC converter AC power cord from the wall outlet.

4 Disconnect the power cable from the Fiber Remote Multi-IPE Interface unit -48 V POWER connector.

5 Disconnect the superloop cables from SUPERLOOP connectors on the Fiber Remote Multi-IPE Interface unit.

6 Disconnect the fiber-optic ST connectors from the Fiber Remote Multi-IPE Interface unit faceplate XMIT A and RCV A optical connectors. If the link is redundant, also disconnect the link from the faceplate connectors XMIT B and RCV B.

7 Remove the unit from the wall or the rack-mounted shelf, as applicable.

8 Reinstall a replacement Fiber Remote Multi-IPE Interface unit in reverse order by setting the S1 and S2 dip-switches, installing the unit onto the wall or into the shelf, connecting the link, connecting the superloop cables, and installing the power cable from the AC/DC converter.

9 Plug the AC/DC converter AC power cord into the wall outlet.

10 Check the power LED on the Fiber Remote Multi-IPE Interface unit. It should be lit permanently if the unit passed self-test upon power up.

11 Enable all superloops by executing the **ENLL** sl command.

12 Press the Reset button to turn off the alarm LEDs.

13 Tag the defective Fiber Remote Multi-IPE Interface unit(s) with a description of the problem and prepare them for shipment to your equipment supplier's repair depot.

Removing and replacing the card in the Fiber Remote Multi-IPE Interface unit

This procedure replaces just the motherboard and faceplate combination and the enclosure remains installed and connected:

1 Log in on the TTY or the MMI maintenance terminal.

2 Disable the Superloop Network card by loading the Network and Peripheral Equipment Diagnostic Program LD 32, and executing **DIS sl**, where **sl** is the actual superloop number of the Superloop Network card.

3 Disconnect the fiber-optic ST connectors from the Fiber Remote Multi-IPE Interface unit faceplate XMIT A and RCV A optical connectors. If the link is redundant, also disconnect the link from the faceplate connectors XMIT B and RCV B.

4 Remove the card from the Fiber Remote Multi-IPE Interface unit by pulling the extractors away from the enclosure.

5 Reinstall a replacement Fiber Remote Multi-IPE Interface card into the enclosure in reverse order by setting the S1 and S2 dip-switches, installing the card into the enclosure, and connecting the fiber-optic link to the faceplate optical connectors.

6 Check the power LED on the Fiber Remote Multi-IPE Interface unit. It should be lit permanently if the unit passed self-test upon power up.

7 Enable all superloops by executing the **ENLL sl** command.

8 Press the Reset button to turn off the alarm LEDs.

9 Tag the defective Fiber Remote Multi-IPE Interface card(s) with a description of the problem and prepare them for shipment to your equipment supplier's repair depot.

Reinstalling covers

When you determine that the Remote IPE is operating correctly, do the following:

1 Reinstall the covers on Meridian 1 module.

2 Reinstall the cover on the Remote IPE module.

3 Terminate you session with Meridian 1 by logging out on your maintenance terminal: type Q at the: prompt and press the Enter key. If using the MMI terminal, log out to complete the test and troubleshooting session.

Packing and shipping defective cards

To ship a defective card to a Nortel Networks repair center, you should:

1 Tag the defective equipment with the description of the problem.

2 Package the defective equipment for shipment using the packing material from the replacement equipment. Place cards in an antistatic bag, put in the box, and securely close the box with tape.

3 Obtain shipping and cost information from Nortel Networks and mail the package to an authorized repair center.

Appendix: Peripheral Controller HEX codes and cable connection diagrams

This appendix lists Peripheral Controller card HEX messages displayed during self-test on the two-character display located on the Peripheral Controller faceplate. It also illustrates the connection diagrams of the Fiber Remote Multi-IPE Interface units at the local and the remote sites.

Peripheral Controller hexadecimal codes

Table 21 lists the Peripheral Controller hexadecimal codes displayed on the faceplate display.

Table 20
Peripheral Controller self-test HEX codes (Part 1 of 2)

HEX code	Test description
01	MPU confidence test
02	MPU internal RAM
03	Boot EPROM test
04	RAM test
05	MPU addressing mode test
06	ID EEPROM test
07	FLASH EPROM test (the programmable part)
08	Watchdog timer test
09	MPU timers test
0A	DUART port A
0B	DUART port B
0C	A31 #1 external buffer
0D	A31 #1 internal context memory (phase A)
0E	A31 #1 internal context memory (phase B)
0F	A31 #1 internal TXVM memory
10	A31 #1 configuration memory
11	A31 #1 external FIFO
12	A31 #2 external buffer
13	A31 #2 internal context memory (phase A)

Table 20
Peripheral Controller self-test HEX codes (Part 2 of 2)

HEX code	Test description
14	A31 #2 internal context memory (phase B)
15	A31 #2 internal TXVM memory
16	A31 #2 configuration memory
17	A31 #2 external FIFO
18	R72 N-P switching control memory
19	R72 320x8 NIVD buffer
1A	R72 N-P Quiet code register
1B	R72 P-N switching control memory
1C	R72 640-8 XIVD buffer
1D	R72 640-8 XIVD loopback buffer test
1E	R72 P-N Quiet code register
1F	R71 register test
20	R71 continuity test, peripheral side
21	R71 continuity test, network side
22	R71 packet transmission test
23	Interrupt test
24	R71 continuity test, peripheral side DS30X

Fiber Remote Multi-IPE Interface units connection diagrams

The following figures illustrate the connection of the Meridian 1 system to the Fiber Remote Multi-IPE Interface units and the fiber-optic link at the local and the remote sites.

The following three figures represent examples of connections at the local and correspondingly at the remote site. These connections represent the following:

— **Figure 15** shows three Superloop Network cards connected to:

- A co-located IPE Module indicated by the Controller Card, the backplane, and the I/O panel.
- Three SUPERLOOP connections to the Fiber Remote Multi-IPE Interface unit.
- Connections to the SDI Paddleboard and other SDI cards as an alternative.
- The system monitor, the fiber-optic link, and the MMI terminal connections.

— **Figure 16** shows multiple Fiber Remote Multi-IPE Interface unit connections:

- Connections to the SDI Paddleboard and other SDI cards as an alternative.
- System monitor connection.
- MMI terminal connection.

— **Figure 17** shows the Remote IPE site with two Remote IPE Modules:

- Each Remote IPE Module is designated with a Controller Card, the backplane connectors, and the I/O panel connectors.
- Shows three SUPERLOOPS, which are extended from the local site, refer to Figure 15, where SUPERLOOP #1 supports one entire IPE Module, SUPERLOOP # 2 and SUPERLOOP #3 support the second IPE Module. SUPERLOOP #4 is not equipped in this example.
- Shows the MMI terminal connection, the system monitor connection, and the fiber-optic link connection.

Figure 15
Local site single Fiber Remote Multi-IPE Interface unit cable connection diagram

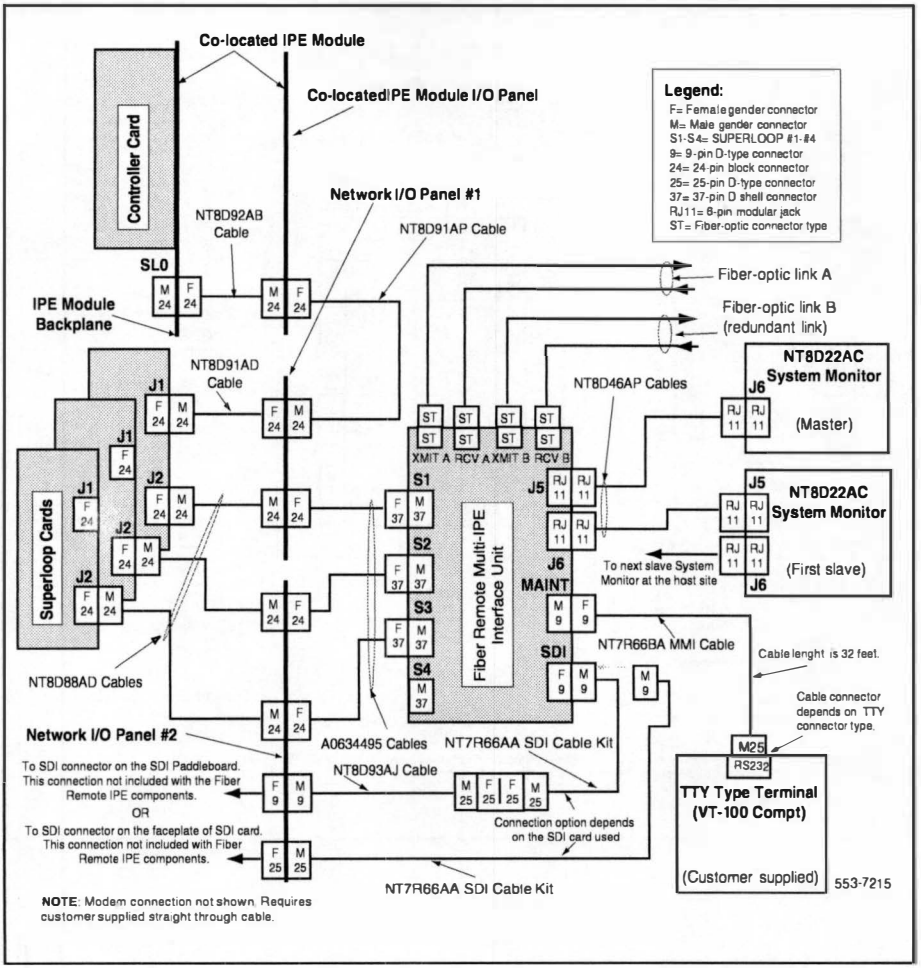


Figure 16
Local site multiple Fiber Remote Multi-IPE Interface units cable connection diagram

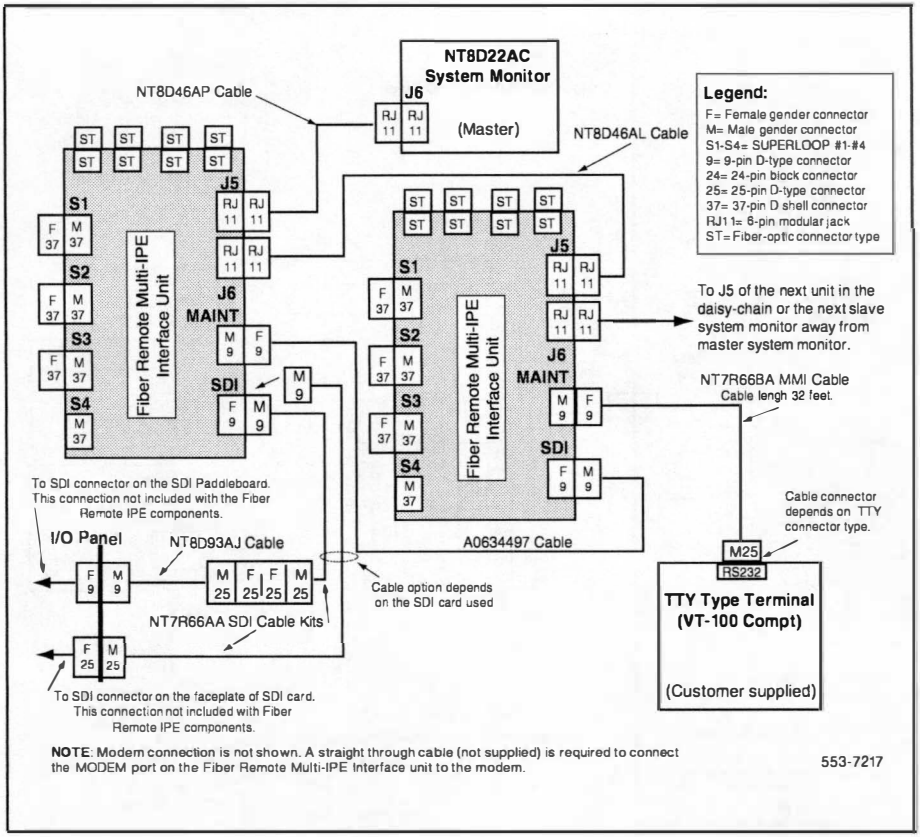
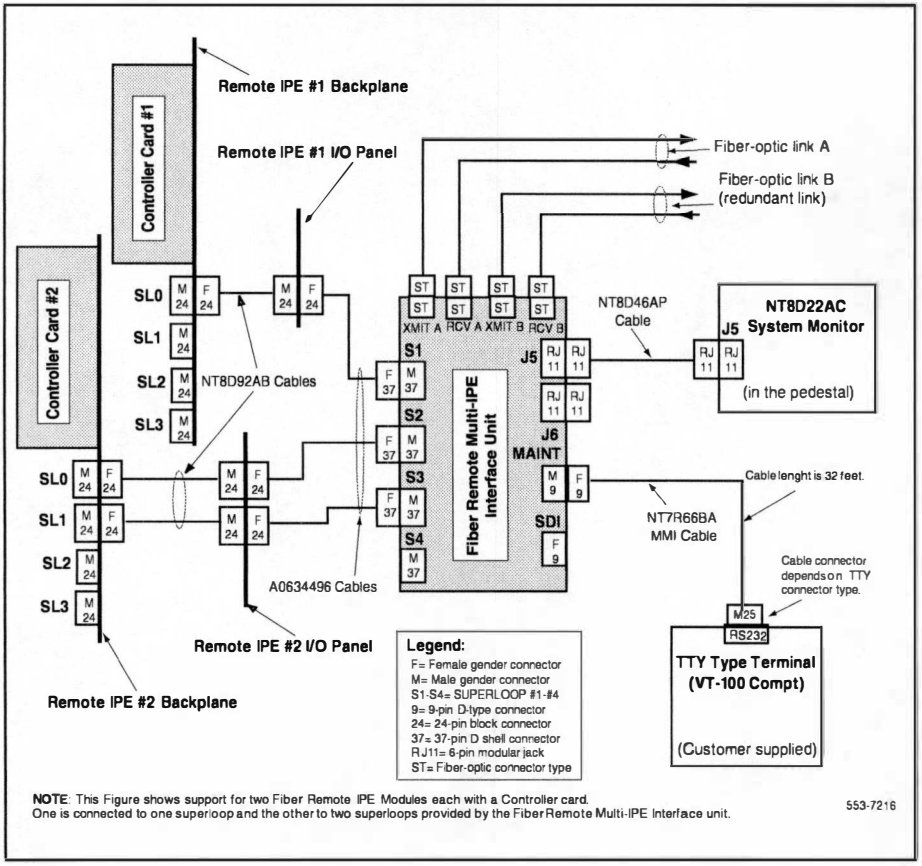


Figure 17
Remote site single Fiber Remote Multi-IPE Interface unit cable connection diagram



NOTE: This Figure shows support for two Fiber Remote IPE Modules each with a Controller card. One is connected to one superloop and the other to two superloops provided by the Fiber Remote Multi-IPE Interface unit.

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Meridian 1

Fiber Remote Multi-IPE Interface

Description, installation, and maintenance

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